The Electrical Industry's Weekly Magazine

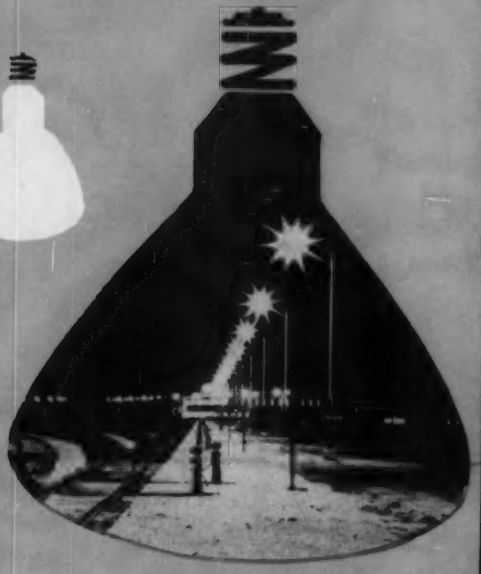
July 22, 1957

Electrical World

Price 50 Cents

A McGraw-Hill Publication

New Look In Outdoor Lighting



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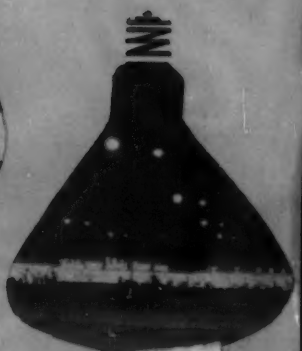

Meet George Armstrong: LG&E's Hard-Working Chief . . . page 81

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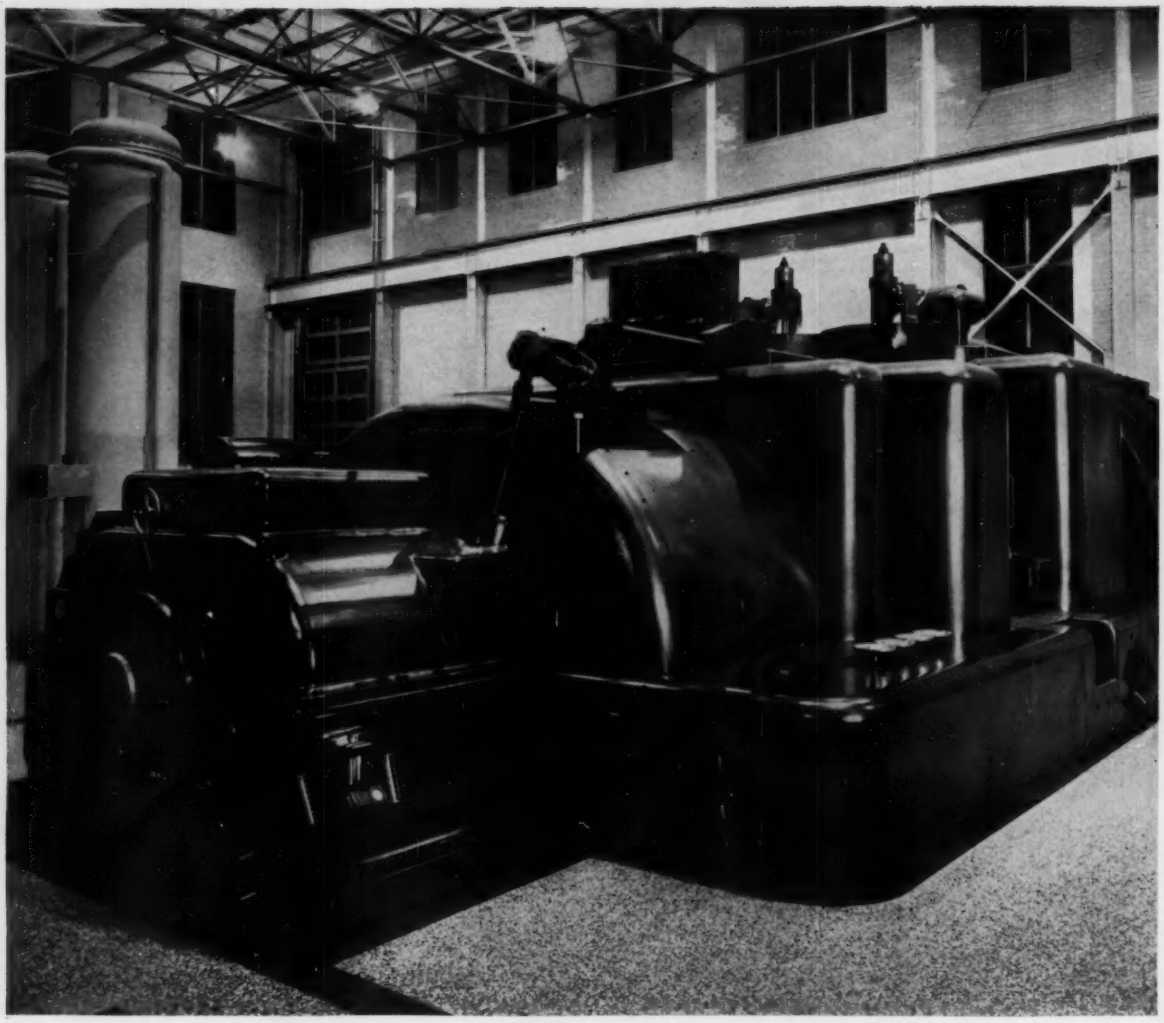

Get the extra safety this long-lived oil provides

Today's power demands permit less time for outages. Turbines are expected to give more dependable, uninterrupted service than ever before. That's why so many operators rely on *Texaco Regal Oil R&O*.

Texaco Regal Oils R&O are especially made to keep turbine systems clean of rust, sludge and foam, to keep bearing temperatures normal and governor response instantaneous. These remarkable oils provide an extra margin of safety throughout an extra-long service life.

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FOR ALL TURBINES

Electrical World

Vol. 148, No. 4 JULY 22, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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It's Plant Dedication Day

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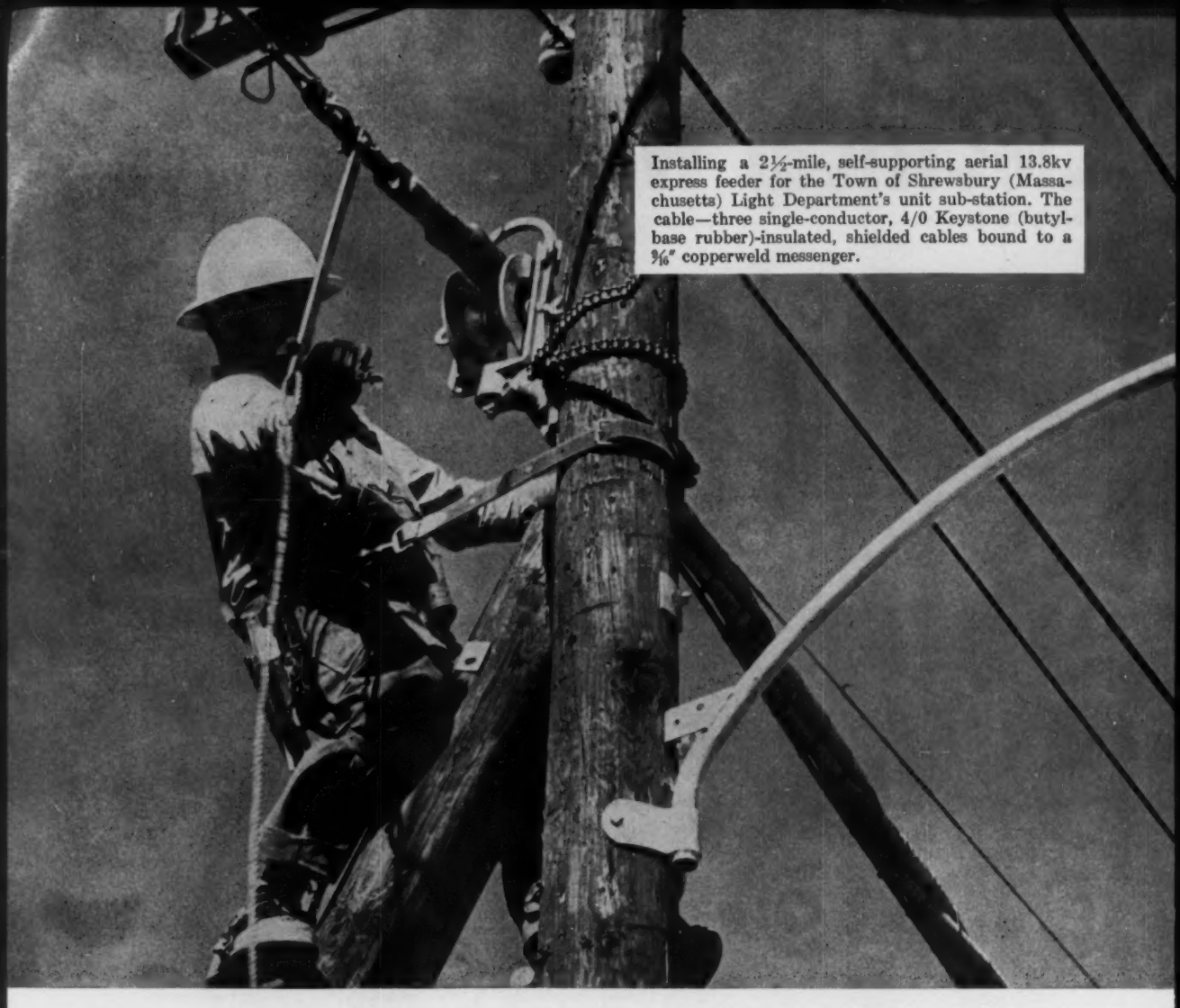

Installing a 2½-mile, self-supporting aerial 13.8kv express feeder for the Town of Shrewsbury (Massachusetts) Light Department's unit sub-station. The cable—three single-conductor, 4/0 Keystone (butyl-base rubber)-insulated, shielded cables bound to a 3/16" copperweld messenger.

Contractor: The Theodore D. Bross Line Construction Company

Modernize with Okonite self-supporting aerial cable...

The Town of Shrewsbury Light Department did just this when they recently installed a 13.8kv express feeder. They chose an Okonite self-supporting aerial cable because they wanted a superior installation that would practically eliminate tree trimming costs . . . be more reliable in storms (operate even with poles down) . . . reduce pole congestion . . . assure fewer interruptions or outages . . . have a moderate cost . . . provide improved voltage regulation because of lower reactance . . . and be more economical to operate and maintain than equivalent open wire lines.

In choosing Keystone (butyl-base rubber)-insulated cables for this important feeder, Shrewsbury Light Department was also banking on high voltage cable with a record for long and dependable service . . . high resistance to ozone and corona cutting . . . ability to take sharp bends . . . stable operation at copper conductor temperatures as high as 85C at 15kv . . . excellent resistance to moisture and extremes of temperatures.

For the complete story on Keystone-insulated cables, contact your Okonite representative . . . or write for Bulletin EW-463 where the results of field service and tests are reported with graphs and charts together with 36 pages of technical data.

The Okonite Company, Passaic, New Jersey.

where there's electrical power . . . there's **OKONITE CABLE**

4912

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. . . from the publisher

"A Cent Buys 14 Ideas"

Into my office last week came one of our younger research-minded editors with what seemed to him a startling bit of information. "Electrical World subscribers," he asserted, "received over 28 lb of information last year." He had weighed the 53 issues published in 1956.

Reluctant to dampen his enthusiasm, I carried this nonsense still further. If the year's issues weighed 28 lb and paper were selling for 50¢ a hundred, then each EW subscription was worth at least 14¢.

Furthermore in 1956 EW filled 2,700 pages with 8,226 articles ranging from briefs to a special report of 52 pages. At $6 a subscription, a cent buys almost 14 idea-filled items.

But getting serious, where else can a man in the electric utility industry get so much of the information which he should have to do his job better, quicker, easier? Articles from the leading authorities in the industry, news gathered by a worldwide industry press association and our editors, all edited by a staff of 20 experts, and displayed and illustrated in the best modern style make an EW subscription not an expense but an investment.

Fischer Black

ELECTRICAL WORLD

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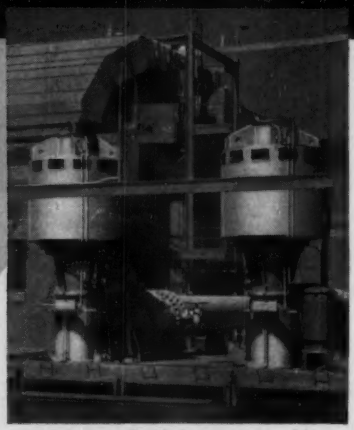
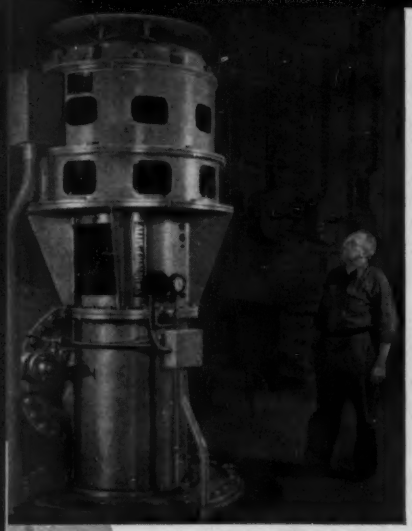
condensing equipment...

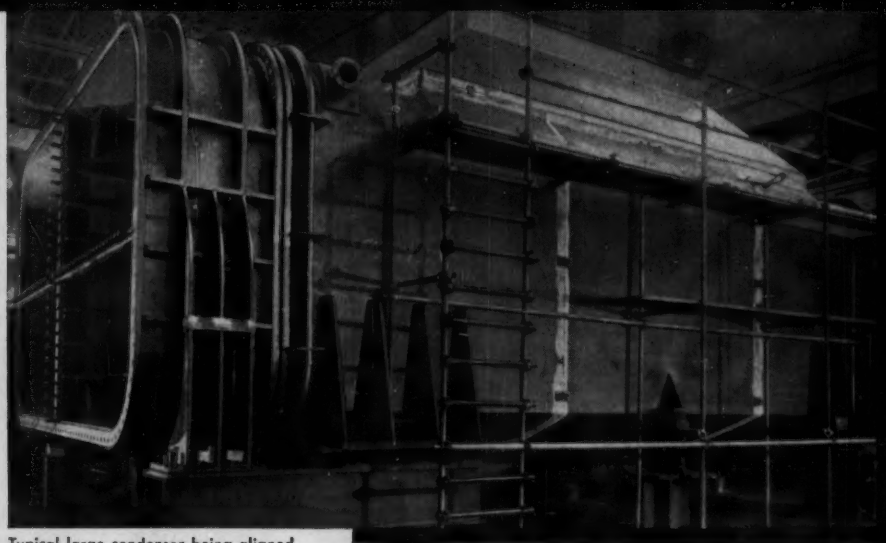


Tube-type Allis-Chalmers motors driving condenser cooling water pump.

Get the whole



Vertical mixed-flow circulating water pump and motor.



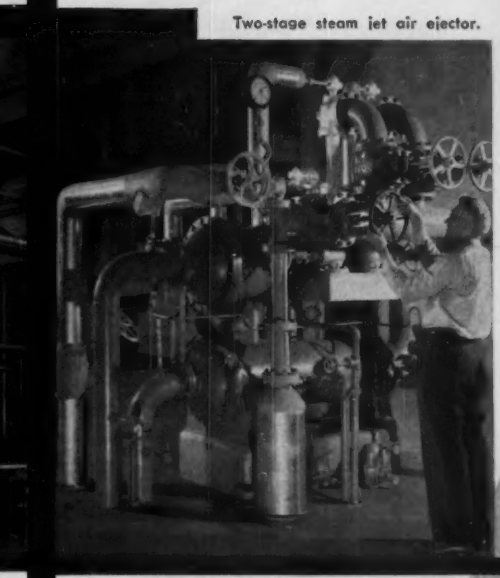
Typical large condenser being aligned in shop prior to shipment.

Two-stage rotary vacuum pump.

Condensate pumps and motors.

"ball of wax"

from Allis-Chalmers



Two-stage steam jet air ejector.

You get all that "unit responsibility" implies in coordination of original engineering, ordering, and installation with Allis-Chalmers condensing equipment.

For A-C builds the condenser with its auxiliary apparatus, including pumps, motors, air removal equipment, switchgear, etc. Moreover, the experience in building millions of square feet of condensers of every size, shape and type enables Allis-Chalmers to meet your special conditions with a high efficiency, high vacuum installation.

for information about Allis-Chalmers condensing equipment, call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

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A-5355

ground rules
FOR GOOD GROUNDS

FOR RELIABLE, LOW-RESISTANCE GROUND CONNECTIONS THE YEAR 'ROUND . . .

use the proved, low-cost method of **deep grounding** with Copperweld Sectional Ground Rods.*

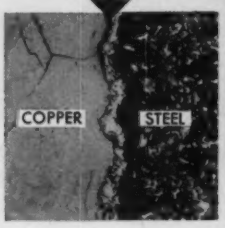
drive multiple sections —as many as are needed to reach the good conducting soils of constant moisture.

measure resistance after each section is driven, allowing for seasonal variation.

to be sure of permanence
be sure to drive Copperweld
the only **Molten-Welded** ground rods.

YOU'RE *Positive* WITH THE **MOLTEN-WELD**

Once it's driven, your ground is in to stay, when it's non-rusting Copperweld. This micro-photograph of the weld area shows how the grains of copper and steel interlock to form a permanent, continuous weld. No other process achieves this inseparable union.



By following these practical ground rules, using Copperweld* Sectional Ground Rods, you can be certain you'll get the very best results from your protective equipment—not only during wet seasons, but throughout the year. There's no better or more economical way to improve line performance, increase safety, and reduce service interruptions.

*Trade Mark

COPPERWELD STEEL COMPANY
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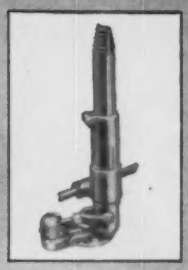
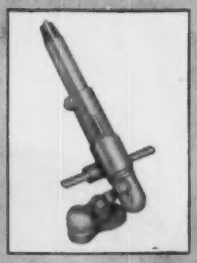
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

Drive DEEP with Copperweld TRADE MARK sectional ground rods



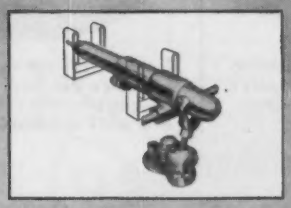
1. SWITCH BLADE IN FULLY OPEN POSITION

Universal link connects blade and crank arm for transmitting forces to the switch blade for full cycle of operation.



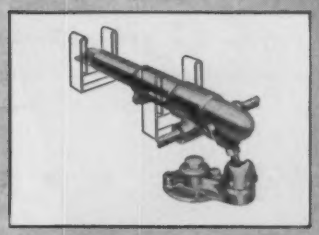
2. SWITCH BLADE CLOSING

Switch blade is moved from the open to closed position by a relatively small angular motion of the crank arm.



3. SWITCH BLADE ENTERS CONTACTS

In this position the switch blade begins its rotation for full contact engagement. Continued movement of the crank arm will rotate the blade to bring contacts under high pressure.



4. SWITCH WITH CONTACTS FULLY ENGAGED

The simple linkage of the WAG concentrates mechanical advantage so that contact engagement or disengagement is accomplished with a minimum of effort.

Simple WAG linkage boosts mechanical advantage; lessens operating effort

In one sweeping, continuous movement the Type WAG Switch blade swings into the open or closed position. There is no lost motion — no cams, triggers, or latches.

The WAG is operated by a simple system of cranks and levers arranged to transmit maximum torque when the blade rotates to engage or disengage the contacts. By concentrating mechanical advantage where it is needed most, the WAG can be operated smoothly and with less effort.

Thus, the Type WAG offers the advantages that engineers recognize as so important: a switch easy to operate, higher contact pressure, and wider contact deflection. The Type WAG has the muscle to break up heavy concentrations of ice and to operate dependably under the most adverse conditions.

For a premium quality switch capable of long, reliable service, choose the Type WAG.

SOUTHERN STATES
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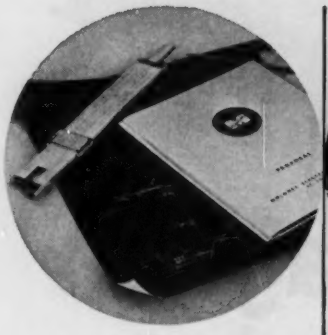
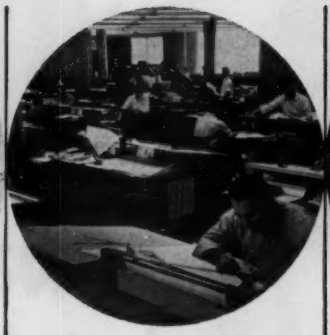
THE PATTERN . . .

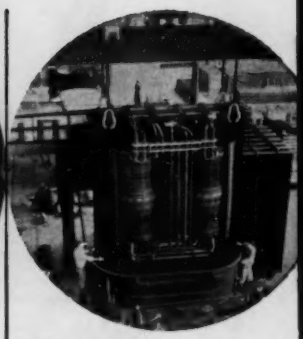


Engineering research augments experience and know-how to make today's product better . . . tomorrow's nearer.



Design experience transfers the thought to plan for product.

Facilities, the finest in the industry, are necessary to produce today's high Kva Moloney Transformers.



Superior production methods assure step-by-step assembly of transformers to meet utility specifications.

True! The only thing you can be sure of is change.

Utility thinking . . . planning . . . needs . . . have changed to meet increasing consumer demands. So, too, it is change at Moloney to keep pace with utility progress. Here, the best transformer today is routine . . . and the best transformer of tomorrow the goal. By research . . . by development . . . and just plain dissatisfaction, we are working to change things for the better.

See us . . . about today's transformer problems . . . tomorrow's . . . or just *because.* Our help is yours . . . just for the asking.

MEM-28

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Power Transformers • Distribution Transformers • Load Tap Changing

Step Voltage Regulators • Primary Unit Substations • Secondary Unit Substation Transformers

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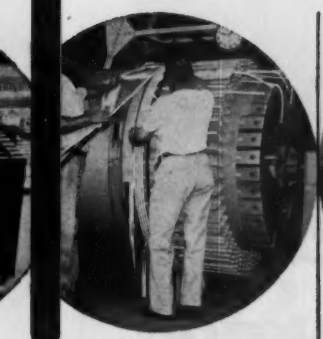
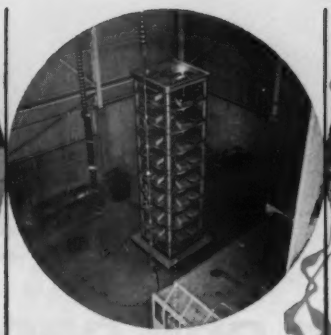
SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS

. IS CHANGE



Fabrication, by skilled, experienced workmen, transposes engineering and design know-how into product.

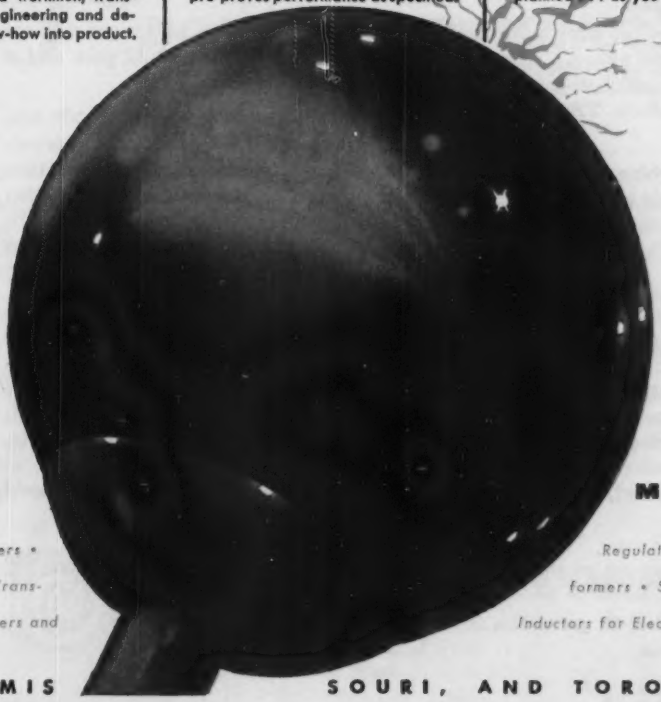


Testing, unsurpassed in the industry, pre-proves performance as specified.

Installed and operating . . . as you planned . . . as you specified.

MOLONEY ELECTRIC

The Sign of Quality . . .
All Along the Line.



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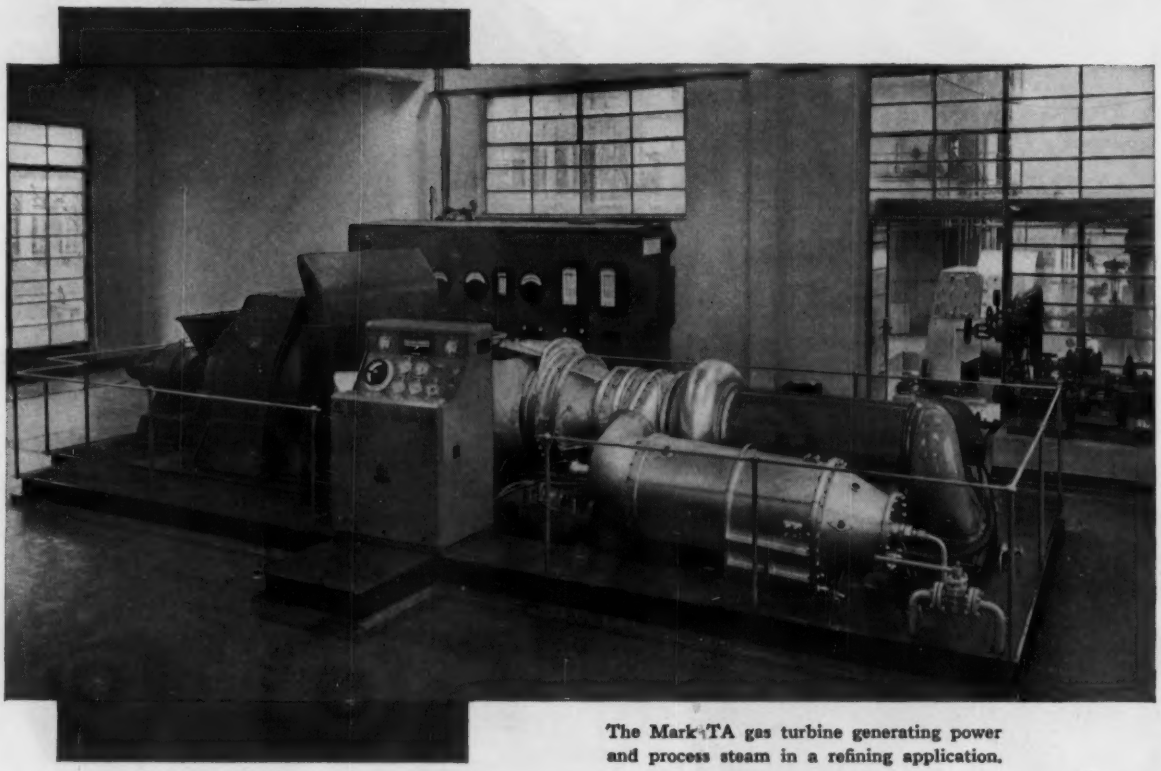

The Mark TA gas turbine generating power and process steam in a refining application.

all power services in one package

In applications where multiple power services are required such as power generation, compressing, pumping, space heating, refrigeration, air conditioning, drying, or evaporating, the Clark Mark TA gas turbine is the economical choice.

Exhaust gases from this 1,150 bhp. gas turbine contain up to 10,000,000 BTU/H of recoverable energy at a temperature of 870°F. While these gases contain some products of combustion, 90% of the original oxygen content is still present.

The exhaust gases are useful where preheated air is desirable for combustion or supercharging purposes, for drying applications, catalyst regeneration, feedwater heating, evaporation of sea water, etc. These gases can also be used in air to air heat exchangers for space heating or to generate up to 9,500 pounds of low pressure steam per hour for process use. If even higher temperature gases are required, the Mark TA can be used solely as a power gas generator to provide gases of 1020°F at 20-22 psia. and a mass flow of 20 pounds per second.

For large stores, auditoriums, hotels, hospitals and office buildings, the Mark TA can provide approximately 1800 tons of air conditioning or refrigeration in the summer using the absorption cycle and also provide steam for heating in the winter. In all applications except power gas generating, this modern gas turbine also supplies 1,150 bhp. of rotative energy for pump, generator, or compressor drive.

Clark engineers stand ready to assist you in applying the Mark TA gas turbine to your application. Larger units with ratings of 9,500 bhp. are also available from Clark. Write for Bulletin No. 142.

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Offices in Principal Cities Throughout the World

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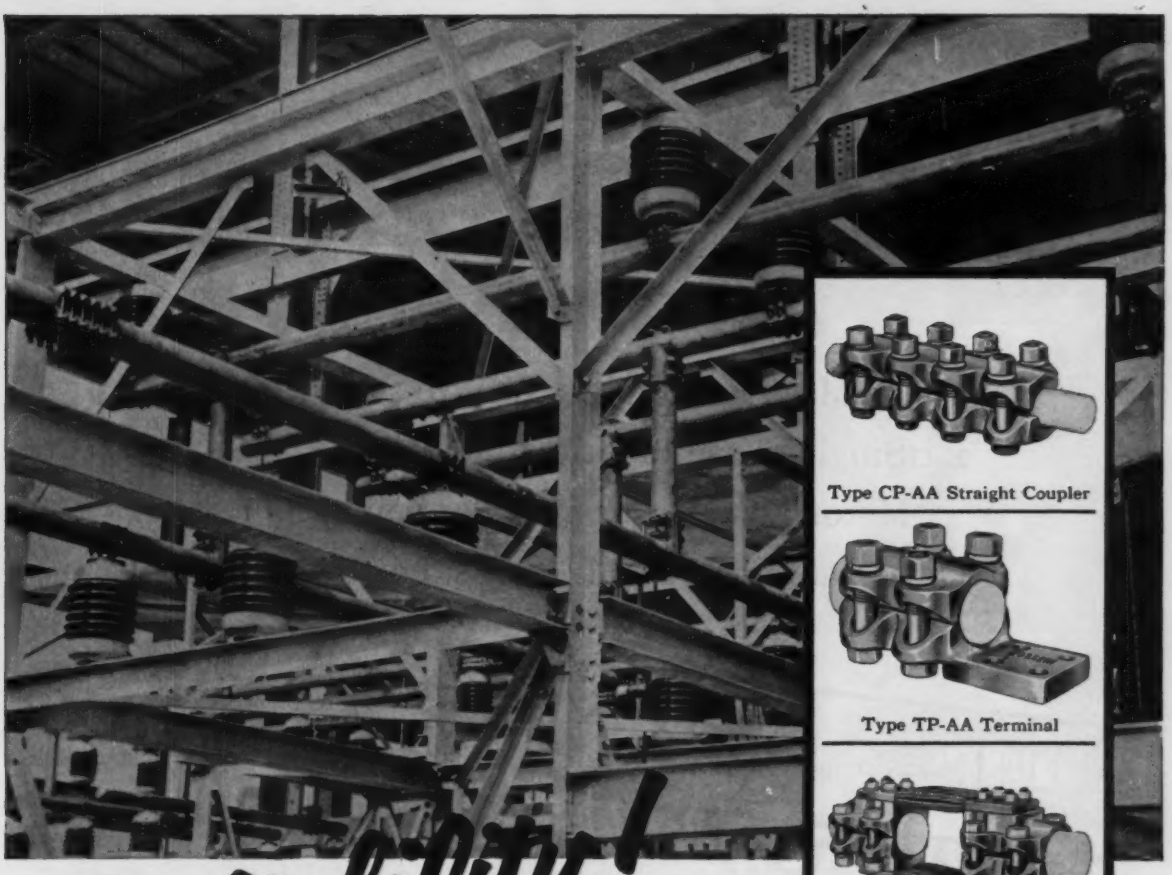

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DOSSERT MFG. CORP.

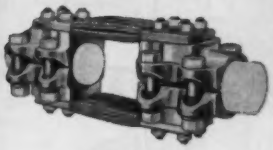
253 Huron Street, Brooklyn 22, N. Y.

Representatives in all principal cities

IN CANADA: W. S. Gerrie & Assoc., Ltd. Toronto

Type CP-AA Straight Coupler

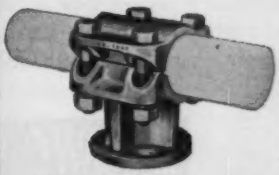
Type TP-AA Terminal



Type XCP-AA Expansion Coupler

Type BP-AA Tee Connector

Type ULKA-AA Terminal



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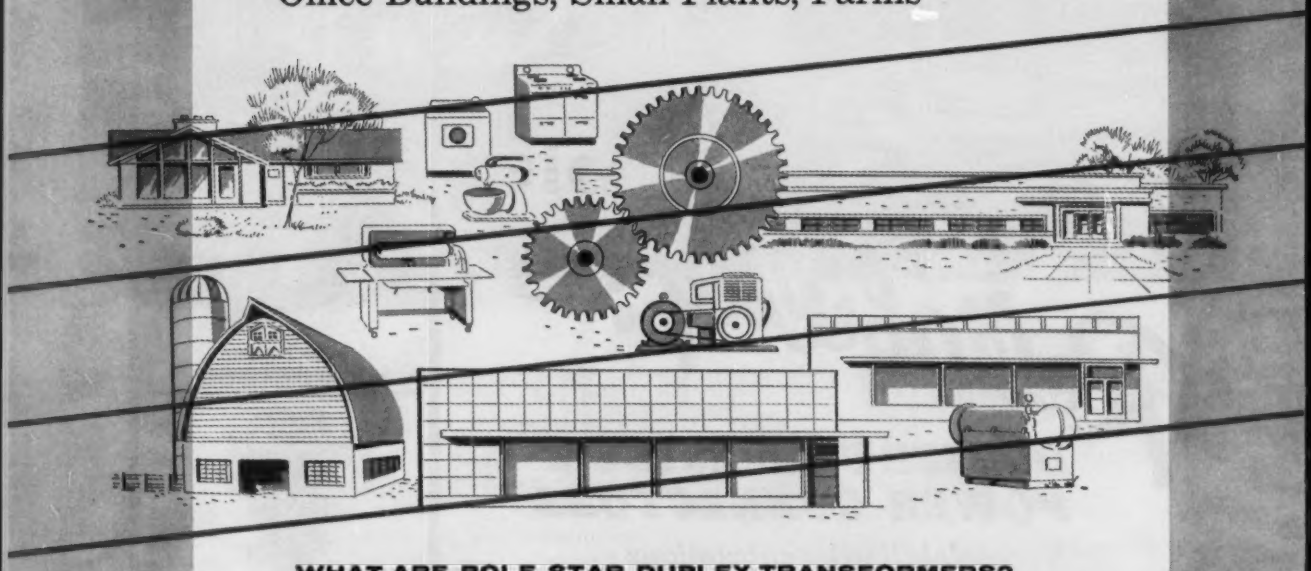
The Most Economical Way to Supply Power for Single-Phase Lighting and Three-Phase Motor Loads in Homes, Shopping Centers, Office Buildings, Small Plants, Farms



WHAT ARE POLE STAR DUPLEX TRANSFORMERS?

Pole Star Duplexes were developed specifically to provide single- and three-phase power simultaneously from single-transformer pole installations. They are composed of two standard core-and-coil assemblies mounted in a single tank—the most common combination being 37½-kva and 15-kva units to provide a total capacity of 52½ kva. Relative proportions of single-phase and three-phase power can be varied according to load conditions.

Ratings range from 20 kva (15- and 5-kva units) to 100 kva (75- and 25-kva units). The high voltage (available from 2400 to 13200 volts, without taps) may be either open delta or open wye, with a low voltage of 240 volts open delta. A 120-volt mid-tap is brought out for single-phase lighting service. All Pole Star Duplexes are available with or without CSP protective equipment.

McGRAW EDISON

PENNSYLVANIA POLE STAR TRANSFORMERS

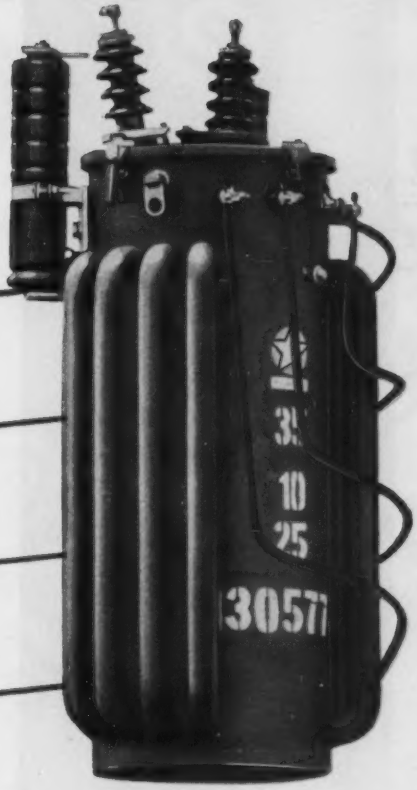
PENNSYLVANIA

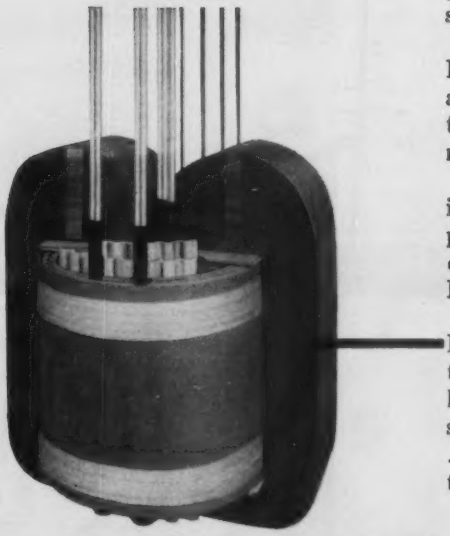
Electrically

by installing

Pole Star

duplex transformers





Greater use of air conditioners, do-it-yourself power tools and other electrical equipment is rapidly increasing the need for multiphase service to homes and commercial establishments. Now, new Pole Star Duplex Transformers make the addition of such service easier—and more economical—by providing simultaneous single- and three-phase power from single pole-mounted transformers.

By eliminating the need for banks of two or three units, Pole Star Duplexes simplify installation . . . lower initial costs as well as long-range maintenance costs. Mounted directly to the pole, the new duplexes require no extra crossarms . . . make a neater appearance than do banks of transformers.

When helping your customers to live better electrically, it will pay you to install Pole Star Duplexes wherever multiphase service is required from pole-mounted units. For more details, write to Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

Like all other Pole Stars, the new duplex transformers feature Pennsylvania's patented lap-on-top core, with "built-in" low exciting current and low core loss. All design and construction features are comparable to standard Pole Stars . . . noted for sustained performance in every type of distribution transformer installation.

DISTRIBUTION TRANSFORMERS

"Magic Touch"

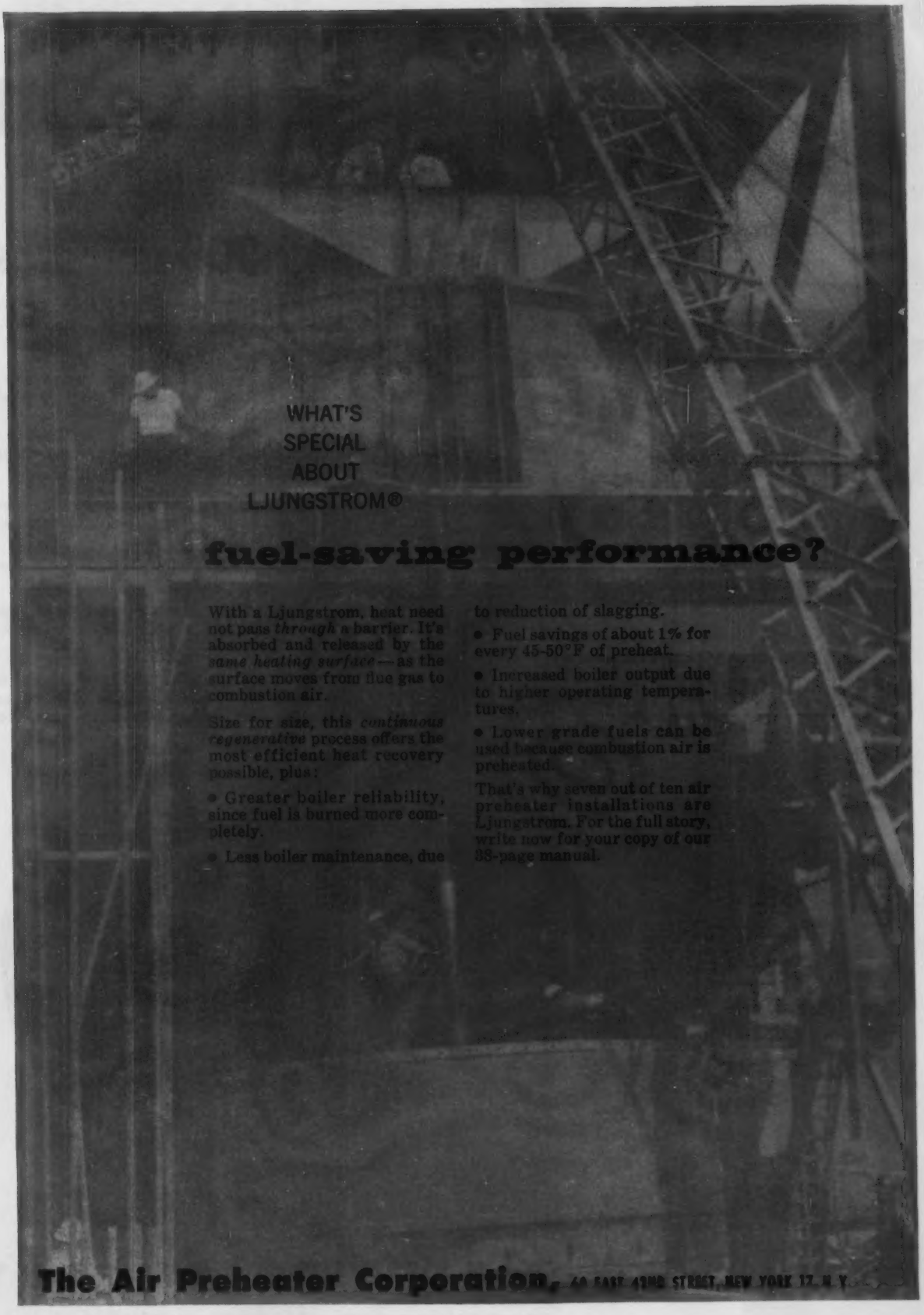
Lights burn and wheels turn when the magic of electricity surges through industry's life line of high voltage cable. Long, intensive testing has proved beyond question that Simplex ANHYDREX XX insulated cable possesses the stability and resistance that assure long, trouble-free service in all environments. Its amazing resistance to ozone and other oxidizing agents make Simplex ANHYDREX XX the logical choice for your high voltage applications. For complete technical data write for Booklet 1023.

SIMPLEX WIRE & CABLE CO.,
79 Sidney Street, Cambridge 39, Mass.

LIVE BETTER ELECTRICALLY

Simplex

ANHYDREX XX


WHAT'S
SPECIAL
ABOUT
LJUNGSTROM®
fuel-saving performance?
With a Ljungstrom, heat need not pass *through* a barrier. It's absorbed and released by the *same heating surface*—as the surface moves from flue gas to combustion air.
Size for size, this *continuous regenerative* process offers the most efficient heat recovery possible, plus:
• Greater boiler reliability, since fuel is burned more completely.
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• Fuel savings of about 1% for every 45-50°F of preheat.
• Increased boiler output due to higher operating temperatures.
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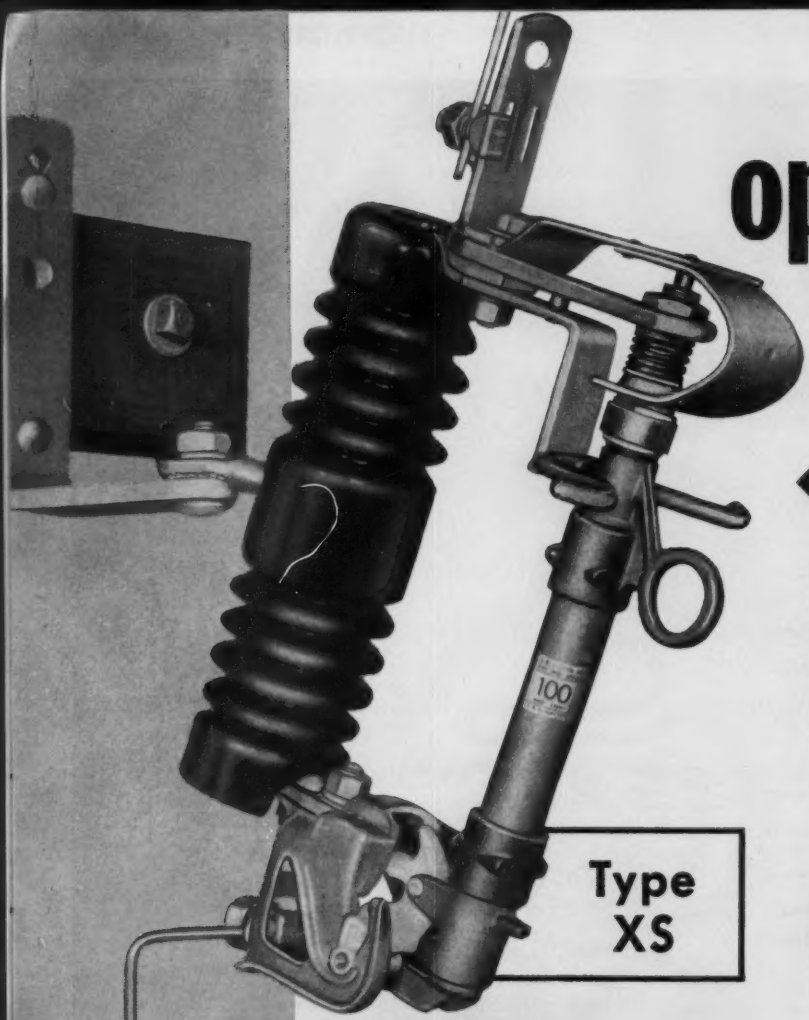
That's why seven out of ten air preheater installations are Ljungstrom. For the full story, write now for your copy of our 88-page manual.
The Air Preheater Corporation, 60 EAST 42ND STREET, NEW YORK 17, N. Y.

A SINGLE-VENTED

open cutout

that will clear 12,000 amperes!

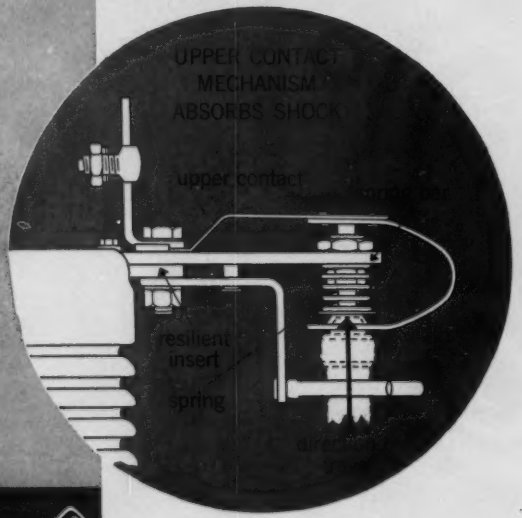


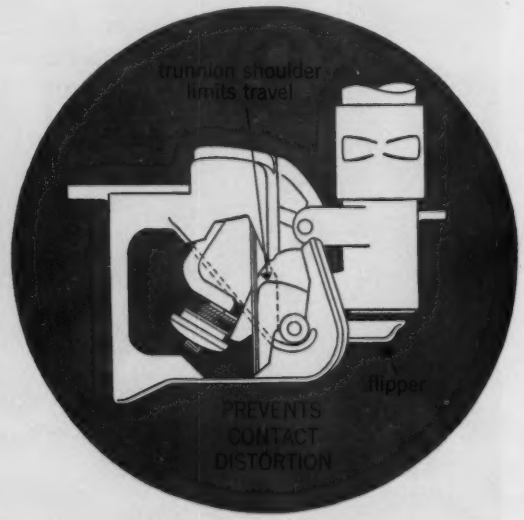
Type XS

Significant new* developments by S&C now take the open cutout to exceptionally high levels of interrupting capacity without sacrificing low fault current interruption ability, without added cost, without double venting, and without disregard for linemen's safety.

- ✻ Controlled placement of fuse link shortens arc length — reduces gas generation.
- ✻ Multistep recoil action (from recoil bar, spring, resiliently mounted insert, contact) absorbs energy when fuse blows.
- ✻ Supplemental recoil action, when trunnion engages hinge casting, dissipates remaining energy.

The XS may be closed on 12,000 ampere faults (7.5 kv rating). And the patented "flipper" feature assures reliable interruption of low-current faults.





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POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

NEWS-SCOPE

FUTURE NEWS ▶ **Plans and site for ultra-modern Engineering Center will be announced soon.** It will be in mid-town Manhattan and house five leading engineering societies.

"Farm Better . . . Electrically" promotion drive will get big push in fall from pump manufacturers. Theme will be "Install running water first."

Comprehensive "Underground Systems Reference Book" is due for publication around August 1. This EEI publication will be first full scale revision of handbook in 26 years.

Next month's Reader's Digest hails growing sentiment in Pacific Northwest for less dependence on the federal treasury in electric power matters. William Hard authored the article.

LATE NEWS ▶ **Things were popping on long-standing Niagara bill last week,** despite stall in Senate by civil rights debate. New companion bill, introduced in House to force Senate action, passed committee without public hearing. N. Y. Power Authority opened two conditional bids for project's 13 large turbines to save time later. And Sen Joseph Clark (D-Pa.) warned he may block the unanimous consent necessary to get the measure past civil rights debate.

Recent explosion in boiler of Glen Lyn plant's new 225,000-kw generator was caused by flame failure and re-ignition of pulverized coal inside the furnace, says Appalachian Electric Power. Cause of flame failure and repair cost have not yet been determined by representatives of American G&E and Babcock & Wilcox.

About 1,000 kw of nuclear power flows into Southern California Edison lines—marking initial delivery from North American Aviation's sodium reactor experiment. SRE is first non-military reactor to produce power for electric generation by a private utility.

Sen Estes Kefauver, in his new "administered price" investigation, plans probe into why consumer price indexes show such a great increase in the price of fuels and lighting.

Progress is made by Florida electric utilities in effort to end dependence on fuel oil by switching to coal as fuel. At last week's Miami meeting, they ended first phase negotiations. "Cost phase"—bargaining on freight rates, etc—comes next.

Bond market last week was a bit "sticky." As EW went to press, underwriters had sold around $14 million of $16-million Texas Electric Service Co bonds (Aa) while the $15-million Jersey Central P&L bonds (A) were on the "slow side."

INDEX ▶ **The index for Vol 147,** Jan. through June 1957, will be inserted in July 29 issue. Extra copies are free on request to: Information Service, Electrical World, 330 W. 42nd Street, New York 36, N. Y.

OUTDOOR LIGHTING ▶ **Yes, you could call it a "revolution" in outdoor lighting.** The postwar trend to outdoor living combined with widespread decentralization of commercial and industrial firms has given big boosts to outside lighting over the past decade. In this issue we present a special 16-page roundup of these developments in the form of a salesman's-eye-view of the outdoor lighting potential and some of the better examples of application (p 87). You'll want to read:

How garden lighting looms as a real plum in residential load building (p 90) and how Hawaiian Electric goes about plucking that luscious fruit (p 92).

How outdoor lighting is used to spruce up some of the elderly office buildings (p 94) and pull customers into shopping centers (p 95) and gas stations (p 97).

How recreational lighting is sold by the "town-full" for all kind of sports (p 98).

How the world's best-lighted airline terminal got that way (p 99).

How industry takes to outdoor lighting as a security and public relations aid (p 100).

EVENTS ▶ **Large generating stations are dedicated** by Indianapolis P&L and New England Electrical System. Although the story covers just two specific plants, it typifies the rapid expansion of the industry (p 72) . . . Which wins out in classy residential neighborhood—substations housed in elaborate residential structure, or less expensive, but neat, utility structure (p 73)? . . . Our continuing series introducing new utility presidents takes you for a visit this week with George Armstrong, top man at Louisville G&E (p 81).

ATOMIC PROGRESS ▶ **Small pilot testing reactor helps scientists** prepare for operating a "big brother" reactor of same type . . . AIEE Pacific general meeting will feature at least four technical papers on atomic energy (p 76).

SYSTEM PLANNING ▶ **How do you maintain acceptable limits of transient stability** on a rapidly expanding system? There are some general guideposts for establishing system design and relaying practices that will minimize problems of stability. You'll find these neatly packaged in a system design article written by a trio of General Electric planning and development engineers. One word of caution from the authors: "Although relaying can be used for splitting a system and for load dropping when instability occurs, it is best to avoid these last-resort measures, if possible, by proper system design (p 80)."

GENERATION ▶ **Adjustable-blade pump-turbine unit to be installed in Brazil will have extra added feature.** Besides its regular double duties, it can also be used as a synchronous condenser to improve system power factor

(p 107) . . . Portable tank with pump for transfer of oil eases maintenance jobs at Southwestern Public Service Co plant (p 112).

SUBSTATIONS ▶ **New ASA bushing standards for outdoor breakers and transformers,** 115 to 230 kv, will offer additional savings from interchangeability and still retain same high degree of reliability. Bushings designed to the new standards have been put through exhaustive laboratory tests and have withstood extensive field tests with flying colors. Article also gives background on new design (p 86).

DISTRIBUTION ▶ **New gimmick for keeping work and statistical records** on distribution transformers saves clerical time at Toledo Edison (p 112).

SELLING ▶ **High frequency induction heating solved a heat treating problem** for stamping and wire forming firm . . . And you'll want to note the advantages enjoyed by a Pennsylvania feed mill when it replaced its 90-hp diesel engine with purchased power (p 124).

Now there's a supermarket for retailing air conditioners—and where but in Texas (p 123) . . . Four electric companies in the Southwest plan coordinated programs to push sale of heat pumps and resistance heating (p 123).

MANAGEMENT ▶ **Beating the credit squeeze is one of management's top concerns** in these days of high interest rates. A staff commentary discusses three possible avenues for gaining more favorable utility financing (p 77) . . . It takes more than a friend-winning campaign to get customers actively on your side. Ralph C. Swartz, vice president, Pennsylvania P&L, offers some philosophical background for improving customer relations in his article on "Rouse-Power" (p 79) . . . Wall Streeter attributes recent dip in electric utility stock prices to higher bond interest and a recent rate development (p 151) . . . Purchasing agents comment on rising equipment prices (p 149).

PEOPLE ▶ **Montana Power elects five new vice presidents,** raises two others to senior vice presidents . . . Anaconda Wire & Cable promotes three to top echelon jobs (pp 157, 160).

MANUFACTURERS ▶ **Step-voltage regulator marks 25th anniversary.** Forerunner of today's version is still in service on Appalachian Electric Power lines (p 142) . . . Allis-Chalmers ships components of the first 300-Mw steam turbine-generator unit to River Rouge Plant (p 144) . . . Pennsylvania Transformer begins work on sound level lab (p 142).

NEW EQUIPMENT ▶ **Hole digger is mounted on truck,** bores holes up to 9 ft 4 in. at various angles in practically any soil . . . Moving cable ground keeps positive ground on conductors during stringing . . . New line of lightning arresters feature small unit but long interrupting distance (p 138).

ENGINEERING TRENDS

Bundled-conductor transmission cannot yet be field-tested for RI in the U. S. because none has been in service long enough to weather. But this condition has been simulated in the Ohio Brass laboratory by moving in weathered conductors from conventional lines and connecting them in bundle configurations without slackening tension.

Another round of atomic contributions to industry is tipped off by the use of radiation from "hot" cobalt-60 to monitor arc-furnace preparation of purified titanium. As applied by Westinghouse researchers, gamma rays emanating through a door in a 4-in.-thick lead shield penetrate 15 in. of less dense metal, including the titanium ingot, to "see" the level of molten titanium at upwards of 3,000F. Information picked off with two scintillation counters is used to position the ingot automatically within 0.01 in. or to shut down the furnace if the ingot gets out of range.

Electrification of main-line railroads moves ahead in Europe and utility engineers still hope for a revival in the U.S. A French report of successful operation of 4,300-hp locomotives with 50-cps commutator motors in freight and passenger service encourages hope that new electrification in the U.S. can be 60-cps. The latest French locomotive, with 3-phase squirrel-cage motors supplied through a frequency-and-phase-converter set in the cab, hauls heavy freight at varying speeds.

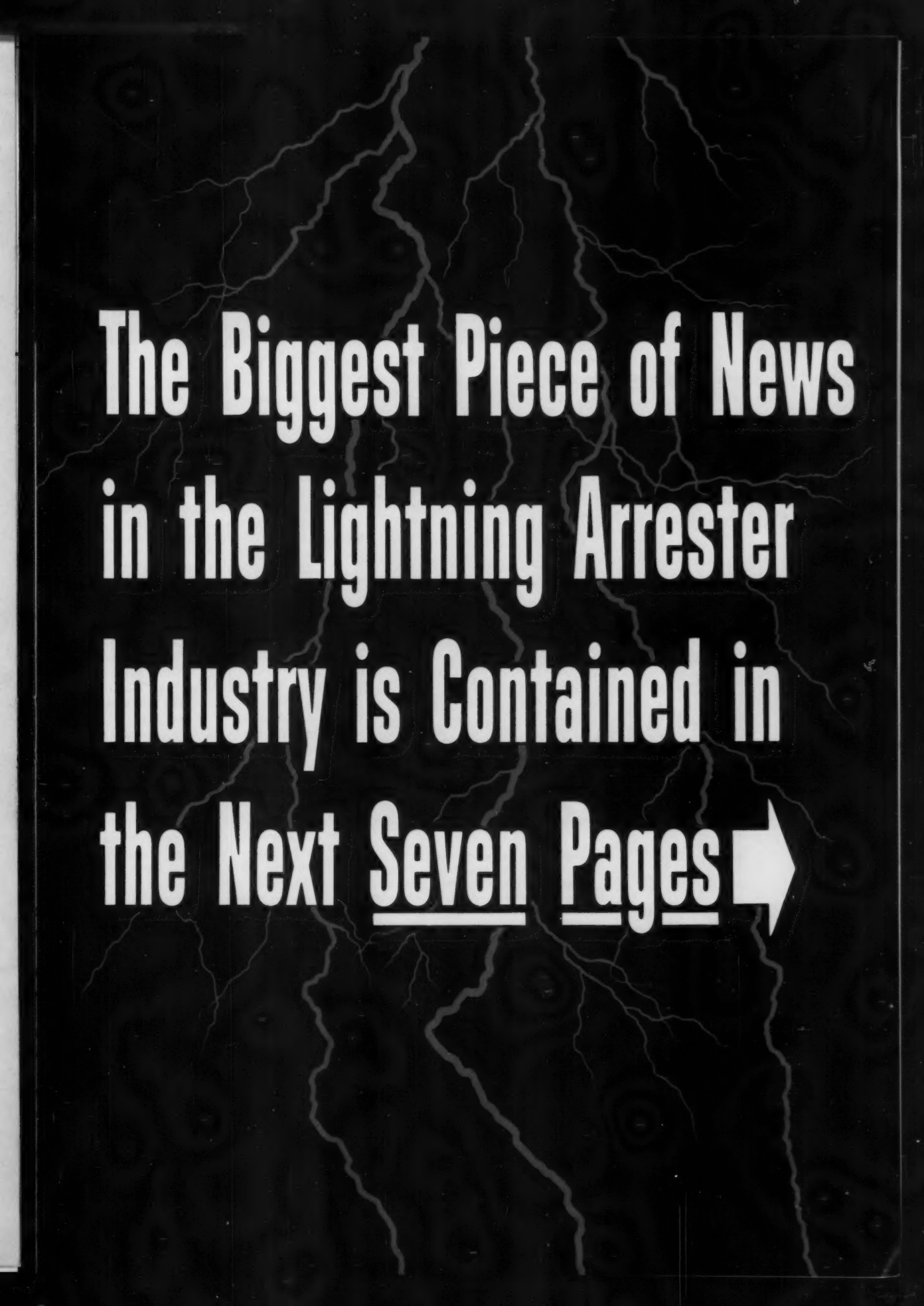
Solar batteries may power the instruments of man-made earth satellites, according to tests by Signal Corps scientists. An experimental installation of the silicon wafers on the skin of an Aerobee-Hi rocket has provided continuous output at altitudes to 190 miles.

Bonding uranium or thorium fuel in ceramic pellets guards against growth and distortion of reactor fuel elements under intense irradiation which threatens the integrity of air-tight reactor vessels.

FROM EDITORS IN THE FIELD

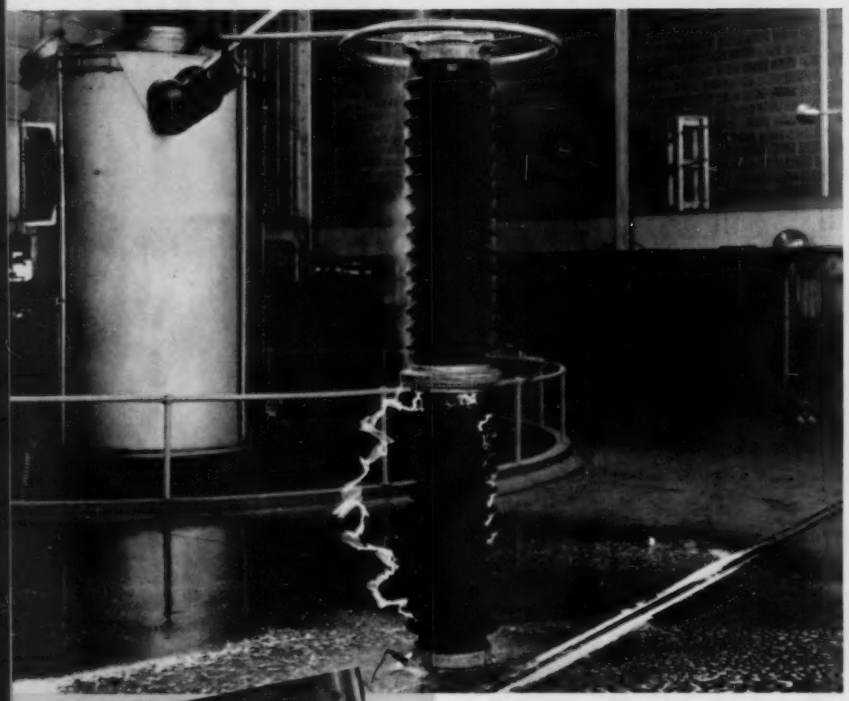
Suspension towers may suffice for transmission angles and deadends if relief is provided for stresses applied by a conductor break. British Columbia Electric Co has accomplished this on a line recently bundled for 345-kv service by putting weak links in crossarms of steel-lattice H-structures to permit arm to bend toward tight span after a conductor break.

Streets and highways glow with new brilliance in Connecticut's drive for better night visibility. Three approaches to Glastonbury's Expressway have 46 new 21,000-lumen mercury units, and the urban district nearby is doubling its lighting with fluorescent units. A Willimantic square has ten 20,000-lumen fluorescents replacing nine older units, and Meriden builds toward a 9-million-lumen future with a light on every second pole.


The Biggest Piece of News
in the Lightning Arrester
Industry is Contained in
the Next Seven Pages

A CLEAN

THOREX Dynagap . . . an Entirely New



No arrester has ever sustained such a test as this! A 276-kv Station Type MPR Thorex Dynagap arrester for 345-kv service was energized at 276 kv line-to-ground and maintained at this voltage for 12 minutes while a cascade of salt water plus wetting agent poured over it, causing a gross condition of surface contamination beyond any field expectation. Sparking between petticoats on the housing was continuous, and open flashover frequently occurred. On the upper-left portion of the housing, steam will be noted, as the outer surface rose to high temperature. In spite of this test that, until now, would be branded "destructive" no reaction of internal elements to external contamination occurred, and the protective ability of the arrester remained un-changed.

Dynagap element as used in Station Type Thorex arresters, and rated at 9 kv, being subjected to duty cycle test. Successive, applications of 10,000-ampere impulse with 60-cycle power-follow current were imposed for 1,000 test cycles. No measurable change of any kind occurred.

• Of the many contributions which Thorex lightning arresters have made to improved equipment protection, the most important by far is the new Dynagap. This has permitted the conception of a new arrester — new in design — new in its functioning parts — new in its electrical behavior and, above all else, new in durability to deal with modern system operating conditions. Here are a few facts to back these statements.

ITEM: In accordance with published Standard tests, the Dynagap protective element was subjected to 1,000 repetitive duty cycle operations. These consisted of an impulse current discharge of 10,000 amperes, 10 x 20 microsecond wave, with accompanying 60-cycle power-follow current. Functioning of this element on the 1,000th shot was identical in all respects to the first. The gap parts were inspected and found to be totally unharmed.

ITEM: Random-selected valve blocks from factory production consistently pass a very severe low-current, long-duration test. Standards call for 150 amperes, 2,000 microsecond wave, for 20 shots. These may be applied in five groups of four shots each; timing between shots being one minute, and between groups 15 minutes to permit block cooling. The Dynagap block test is conducted at 650 amperes instead of 150. Impulse shots are applied continuously at the fastest cycling rate of the generator, approximately 20 seconds apart. No delay is permitted for block cooling. Over 430 per cent Standard test current is applied in 1/7 the allowable time with no harmful effect.

ITEM: A high-voltage station type arrester for 345-kv service was maintained at full 60-cycle line-to-ground rated voltage for 12 minutes. During this time a continuous cascade of salt water plus wetting agent was pouring over it. Such a test would cause certain

SWEEP!

Conception of Lightning Arrester

external flashover of conventional insulation. The arrester was continually "alive" with violent surface leakage discharges and frequently flashed-over portions of the housing. At no time was there sparkover or any other reaction of internal parts to this extreme degree of surface contamination at sustained operating voltage.

ITEM: Housings of all Station Type Dynagap arresters above 69 kv are functionally one-piece, electrically and mechanically, and no larger in height or diameter than equivalent-rated switch insulator stacks. They are completely self-supporting at all voltages. As an example, the Thorex Dynagap arrester for 230-kv service is a simple, unobstructed, self-supporting column with housing dimensions of 16¾-inch diameter by only 86-inch height.

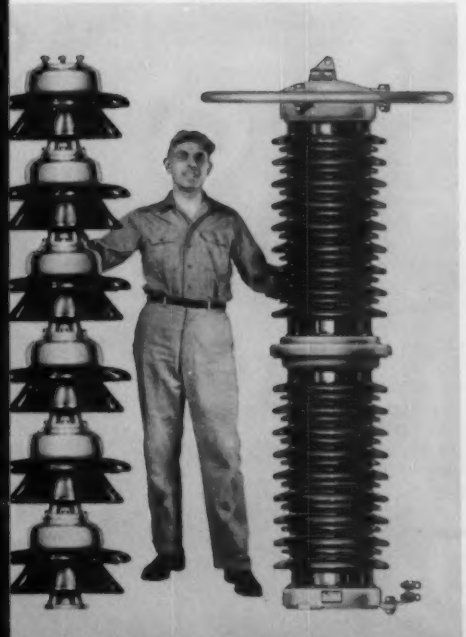
ITEM: Because of the extreme adaptability of the new Dynagap, identical parts are used in all grades of present Thorex arresters. Intermediate types benefit vastly from this advantage.

ITEM: No sacrifice has been made in protective characteristics to gain any of the foregoing advantages. Thorex arresters still lead in this most essential quality.

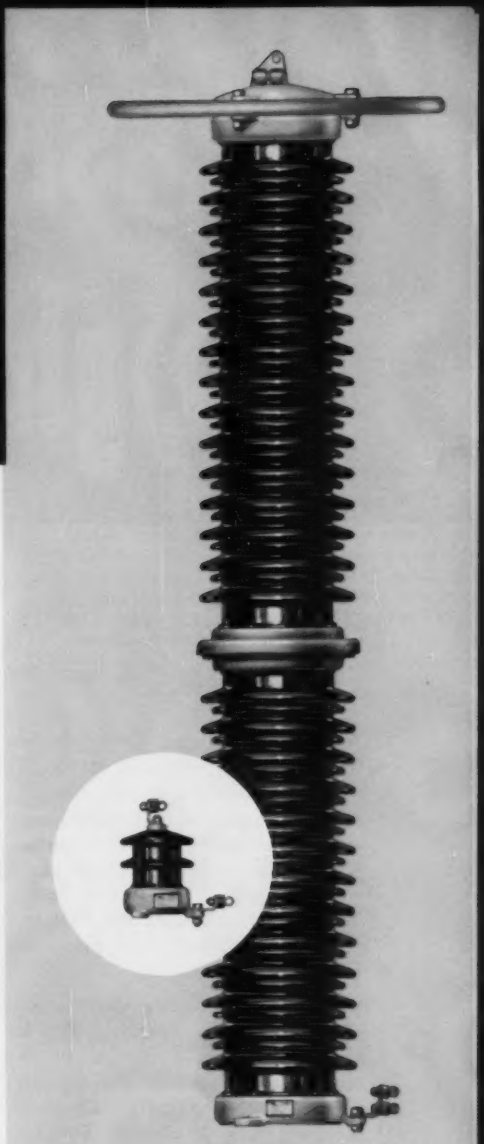
You will probably agree that "improvement" is not an adequate word to express the advancements which the Dynagap has brought to lightning arrester technology. This ingenious invention is, legitimately, a breakthrough in development.

OHIO BRASS COMPANY
MANSFIELD, OHIO

Ohio Brass



The striking height reduction attained in the new high-voltage Station Type Dynagap arrester series is demonstrated here at an operating level of 230 kv. The arrester and a NEMA Standard station insulator stack level-off at approximately 86 inches. This physical advantage can mean tremendous construction savings, and it permits location of the arrester closer to protected equipment. No longer need purchased protection be sacrificed because of large separation distance. Compact size likewise allows the use of functionally one-piece housings that eliminate contamination damage at high voltage.



An Intermediate Type GP arrester for 4-kv primary service, and a Station Type MPR for 345-kv "super-power" may be far apart in size and voltage rating, but both contain the identical Dynagap element. Because of this, both likewise enjoy the privilege of newly-compounded valve blocks developed for optimum service performance, and no longer subject to the compromises once demanded of blocks by conflicting requirements.

More details are presented in the following pages

A Basic Development In Lightning Arresters

The Revolutionary New..

• A few years ago, Thorex Station Type arresters, MP and MPR, pioneered the use of magnetic means to expand and cool the 60-cycle arc as an aid to power-follow current limitation. Through the use of a labyrinth in the arcing chambers, a maximum gap length of 1.3-inches per kv of arrester rating was attained. Until today this has not been equalled.

Stretching and cooling the arc rapidly builds-up arc resistance. This resistance supplies a portion of the arc-extinction function and transfers that portion of duty from the valve blocks, into the gap element. A notable improvement in this direction was achieved by the original Thorex magnetic arc control.

Development engineers, observing this, could visualize a revolutionary type of arrester if the power-follow current limitation function of the gap could still further be increased. In other words, how could gap resistance be multiplied? How could maximum gap length be doubled, or more, in any practical physical size? The principal was this simple: the longer the gap length per kv of rating, the greater the resistance that could be built-up within the gap, to an ultimate point where the system could no longer supply voltage to overcome this resistance, and the arc would extinguish. With every increment of this attractive goal would go a corresponding opportunity to improve the composition of valve blocks in a desirable direction.

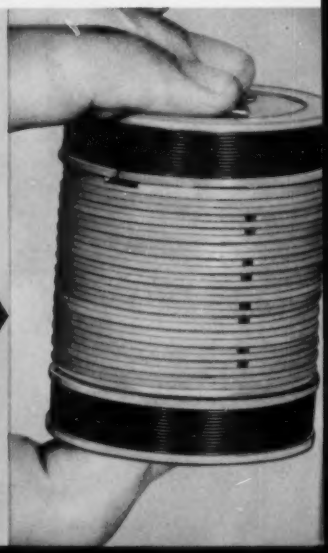
Here is the story of the Dynagap in a nutshell. Maximum gap length, compared to the former Thorex MP and MPR types, has been increased from an original length of 1.3 to 7.3 inches per kv of rating — 560 per cent. The new Dynagap arrester for 345-kv service, for example, now has 170 feet of gap!

It was considered a definite attainment, originally, to transfer approximately 10 per cent of the power-follow current limiting duty away from the valve blocks and into the gap element. The new Dynagap now takes about 90 per cent.

Added to this striking improvement in efficiency, the Dynagap has extremely positive operation in its extinction function. It has inherent, instantaneous, automatic linear gap grading at

Opening the Dynagap element at any point will reveal a pair of electrodes on opposing surfaces of Mycalex plates. By a method of indexing, accurate gap spacing is obtained on assembly. Electrodes are on opposite sides of each plate, and riveted through the plate, to obtain series connection of the 12 gaps forming a complete element. Between sparkover and extinguishment, the arc is stretched 140 times its original length and is forced magnetically between closely-spaced cooling surfaces in the arc expansion chambers.

Magnetic coils above and below the Dynagap element drive the power-follow arc into the expansion chambers. In the center of each coil is a disc of valve block material having non-linear resistance characteristics and connected in parallel with the coil. Lightning impulse current passes through this block, across the close setting of the gaps, through the main valve blocks, and to ground. Power-follow current at line frequency and voltage is impeded by the high normal resistance of this by-pass block, but readily flows through the coils, thus creating the desired magnetic field to expand and extinguish the arc.



The basic Dynagap element, 2 inches in diameter and 1.43 inches in height. In this small structure of about 3 cubic inches is contained 33 linear inches of gap.

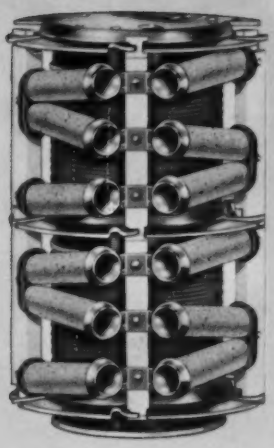
THOREX® Dynagap

the moment of discharge that positively prevents re-strike beyond 60-cycle current-zero. In most cases, extinction occurs well in advance of the current-zero point.

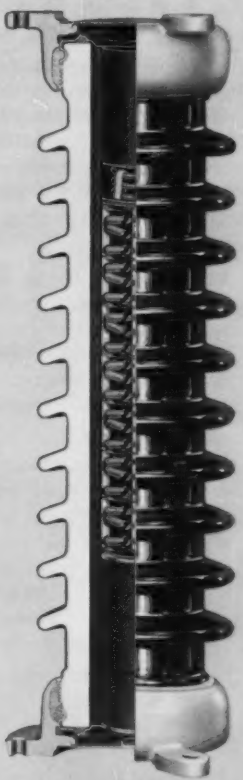
Restrictions on valve block composition have practically disappeared. New Thorex blocks are a radically improved development. Modern power system operating conditions: higher voltages, longer lines, rapid expansion of underground cable transmission, increased use of static capacitors — to name just a few — have imposed a new order of demands on lightning arrester protection and durability. These fall into the category of long-duration transient currents of either natural or system origin. This severely taxes the durability of conventional arresters. The answer to this has been obvious — more specialized valve blocks to deal with these increased demands. But, this ideal remained in the realm of conjecture as long as blocks were forced to perform the major, and conflicting, function of power-follow current limitation. This requirement has all but disappeared. Thorex blocks now have the high degree of specialization demanded by present-day requirements.

While the new Thorex Dynagap lightning arrester has many other striking features, probably its most important single property is increased durability — durability of an entirely new order, that not only matches but exceeds the severe demands of modern power system operation.

OHIO BRASS COMPANY
MANSFIELD, OHIO



Complete Dynagap structure as used in Station Type Thorex arresters. In such application, the unit shown has a rating of 9 kv. Sufficient elements are combined to reach full arrester rating. External resistors are of non-linear type and function in electrical grading.



Cross-section of a Station Type MP-30 Dynagap arrester as normally applied to 34.5-kv operating voltage. Relation of gap elements and valve blocks is clearly shown.

Ohio Brass

For the story of how the contamination problem has been mastered . . . TURN THE PAGE

Dynagap Radically Reduces High-Voltage Arrester Size

...Yields Striking Advantages

● The basic Dynagap structure is only two inches in diameter by 1.43 inches in height, yet presents a total arcing path of 33 linear inches. This highly efficient device opens the way to a revolutionary arrester advancement.

It is possible to stack three physically parallel columns of arrester parts within the 16¾-inch-diameter housing of the Station Type MPR Thorex arrester. This has the effect of reducing over-all height to one-third that of conventional end-to-end assembly of internal parts.

Result of this height reduction is a lightning arrester for use above 69 kv, that, at equivalent ratings, levels-off almost exactly with the top of a stack of switch and bus insulators, or the projection of a bushing above the apparatus tank.

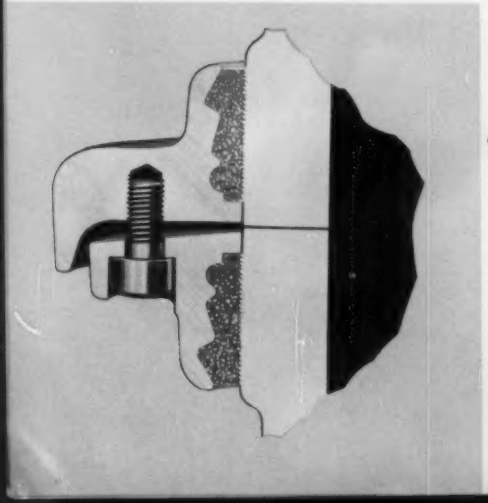
Space saving, construction cost, convenience, and equipment protection are all favored to a remarkable degree. Almost anywhere an insulator stack can be located in station construction, so can a type MPR Thorex lightning arrester. There is no need for special, elaborate steelwork or costly foundations. Now, more than ever, it is feasible to mount arresters directly adjacent to bushings on the apparatus tank. In any case, the arrester can be close to its major equipment, thus cutting lead length and improving protective performance. Only the three larger sizes for service voltages between 230 and 345 kv have grading rings, and these rings are only 38½ inches in diameter. All other ratings are simple, clean columns, 16¾ inches in diameter and, as was stated, the height of an insulator stack.

Basic Dynagap element, full size. By incorporating 33 linear inches of gap into such a small structure, it is possible to obtain an extremely favorable ratio of power-follow limitation between gaps and blocks, and still accomplish a radical reduction in over-all arrester size.

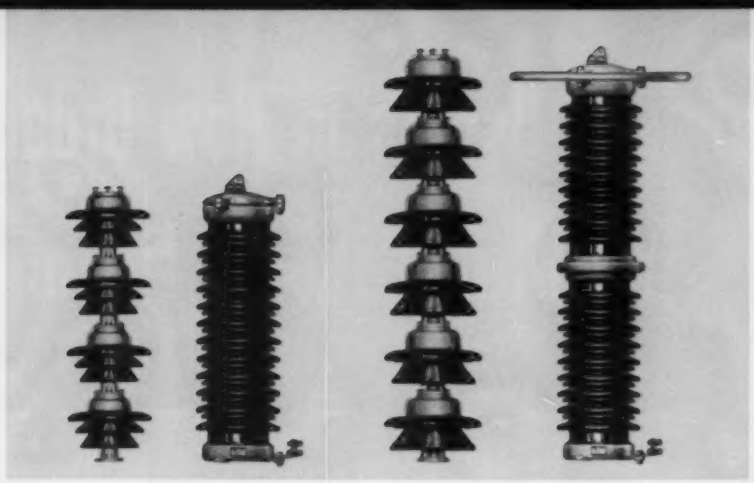
But, this is a minor point in comparison to another advantage of compact dimensions. Every type MPR arrester, all the way to 345 kv, has a porcelain housing that is functionally one-piece, both electrically and mechanically. The high voltage stack of separate, multiple units has been eliminated. Likewise eliminated is the most common cause of damage to arresters of this class.

Air-borne contamination is rapidly increasing in both extent and severity. It is either an existing problem or is anticipated in nearly every high voltage station. Accumulation of surface contamination results in external leakage when moisture is present. Conventional high-voltage stacks of multiple units introduce this leakage current into the sensitive arrester circuit at every stack connection. When such current becomes sufficiently high, it imposes voltage above rating on a portion of the stack, and has the effect of shorting-out one or more top units. No arrester has been able to withstand severe cases of this.

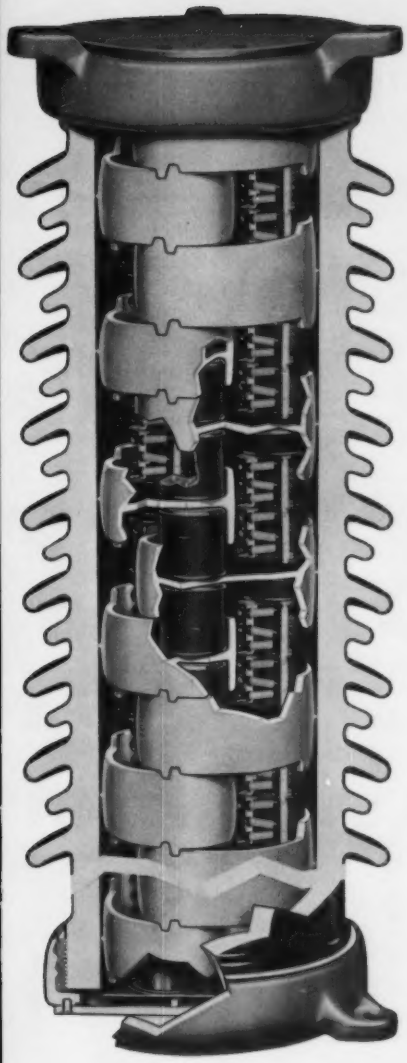
The one-piece housing of type MPR Dynagap arresters attacks this trouble at its source. Leakage currents are kept outside where they bleed-away harmlessly. They have no effect on internal arrester parts because they cannot reach them. Reference is made to the introductory discussion where a 345-kv Dynagap arrester is shown flashing-over while being deluged with a salt solution. Even at the extreme level of surface contamination and wetting resulting in external flashover (an unheard-of situation with arresters) internal parts were un-affected.



Detail of the connection flange used on larger sizes of Station Type MPR Dynagap arresters. It will be seen that all metal parts are attached only to the outside surface and no electrical path exists to conduct leakage currents into the internal arrester grading circuit. The two porcelain parts are accurately ground, and their matching surfaces are bonded with Epoxy resin. This material establishes a joint that is stronger, both electrically and mechanically, than the porcelain. Flanges are an aid in factory assembly of the two parts, and remain in place later merely to increase safety factors in the joint area.



Two popular type MPR arrester sizes, for operating voltages of 138 and 230 kv, compared to NEMA Standard station insulator stacks. This striking size similarity permits mounting high voltage arresters in heretofore un-available station locations. Major construction cost savings can be effected.



Internal elements of the Station Type MPR Dynagap arrester are arranged in three physically parallel columns inside the 16¾-inch housing. All parts are electrically connected in series, and the discharge follows successive S-shaped paths. This efficient internal construction accounts for the short height of the arrester.

A further advantage in this design relates to periodic washing. Any single-housing Thorex arrester may be hot-line washed. Since this type of arrester construction extends even to 345-kv system voltage, it offers an opportunity to apply washing procedures to arresters of the highest ratings.

A few larger sizes of type MPR Dynagap arresters will be seen to have a metal band about the central portion of the housing. This is entirely on the outside surface and has no connection to internal parts. These large housings are produced in two pieces. Their ends are precision-ground and bonded with an Epoxy resin that is considerably stronger than the porcelain body. It also has higher dielectric strength than porcelain. From a mechanical or electrical standpoint, the housing is functionally one-piece in every respect. The metal band merely aids factory assembly and provides large safety factors at the joint line.

OHIO BRASS COMPANY
MANSFIELD, OHIO

Briefly, these are the highlights of the new O-B Thorex Dynagap. It brings to lightning arresters an entirely new conception of durability, performance, and physical size. It cannot help but stimulate future industry-wide design, as well as industry-wide standards of protection.

You can exploit these basic advancements now, however, by specifying Thorex Dynagap arrester equipment on any class of new construction, from primary distribution to the highest transmission voltages. **A quick summary of available arrester types is presented on the following page.**

Take a big step forward in establishing a higher level of arrester performance on your system — install your first new Thorex Dynagap bank as soon as possible.

Ohio Brass

Dynagap Ushers in New Order of Performance for All O-B Thorex Lightning Arresters

No other lightning arrester has ever approached this combination of modern advancements —

- An entirely new conception of switching surge durability.
- Elimination of internal damage due to surface leakage currents at high voltage.
- Reduction of high-voltage arrester size to that of regular station insulation.
- Increased ability to withstand 60-cycle over-voltage.
- Over-all design geared to present-day system operating demands.

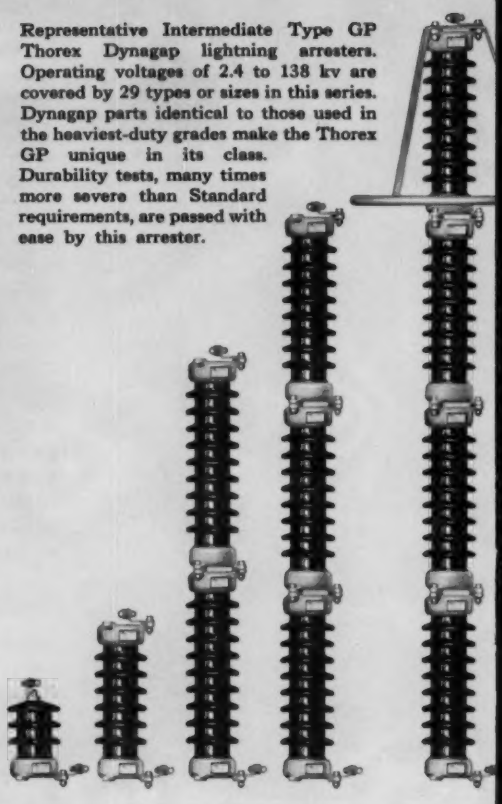
All these features — and many more — are yours when you specify the revolutionary new O-B Thorex Dynagap lightning arrester. Put it to work, now!

OHIO BRASS COMPANY
MANSFIELD, OHIO

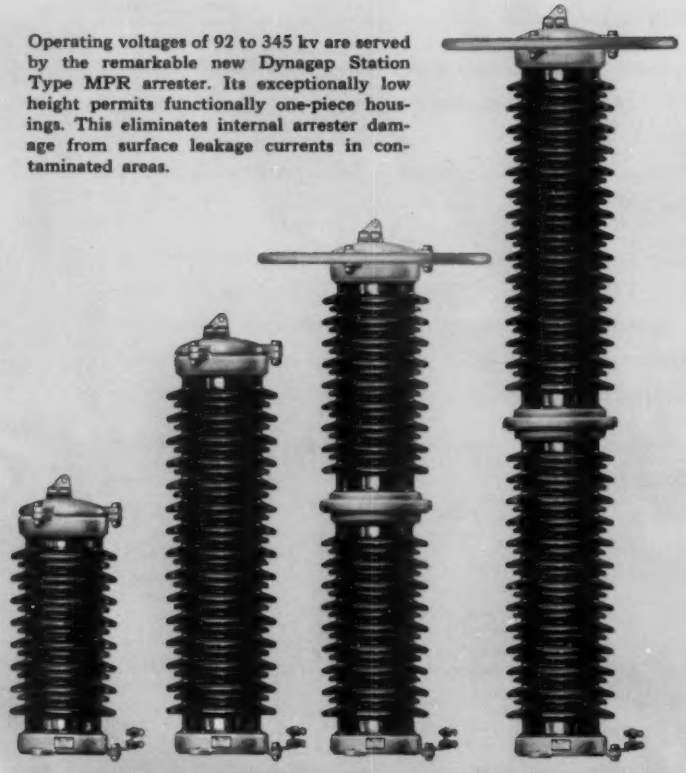
Ohio Brass

4775-H

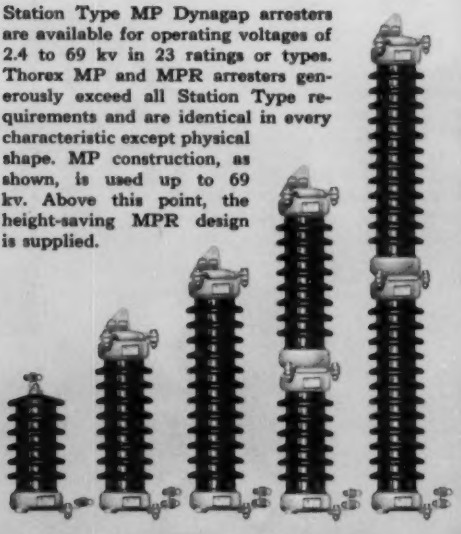
Representative Intermediate Type GP Thorex Dynagap lightning arresters. Operating voltages of 2.4 to 138 kv are covered by 29 types or sizes in this series. Dynagap parts identical to those used in the heaviest-duty grades make the Thorex GP unique in its class. Durability tests, many times more severe than Standard requirements, are passed with ease by this arrester.



Operating voltages of 92 to 345 kv are served by the remarkable new Dynagap Station Type MPR arrester. Its exceptionally low height permits functionally one-piece housings. This eliminates internal arrester damage from surface leakage currents in contaminated areas.

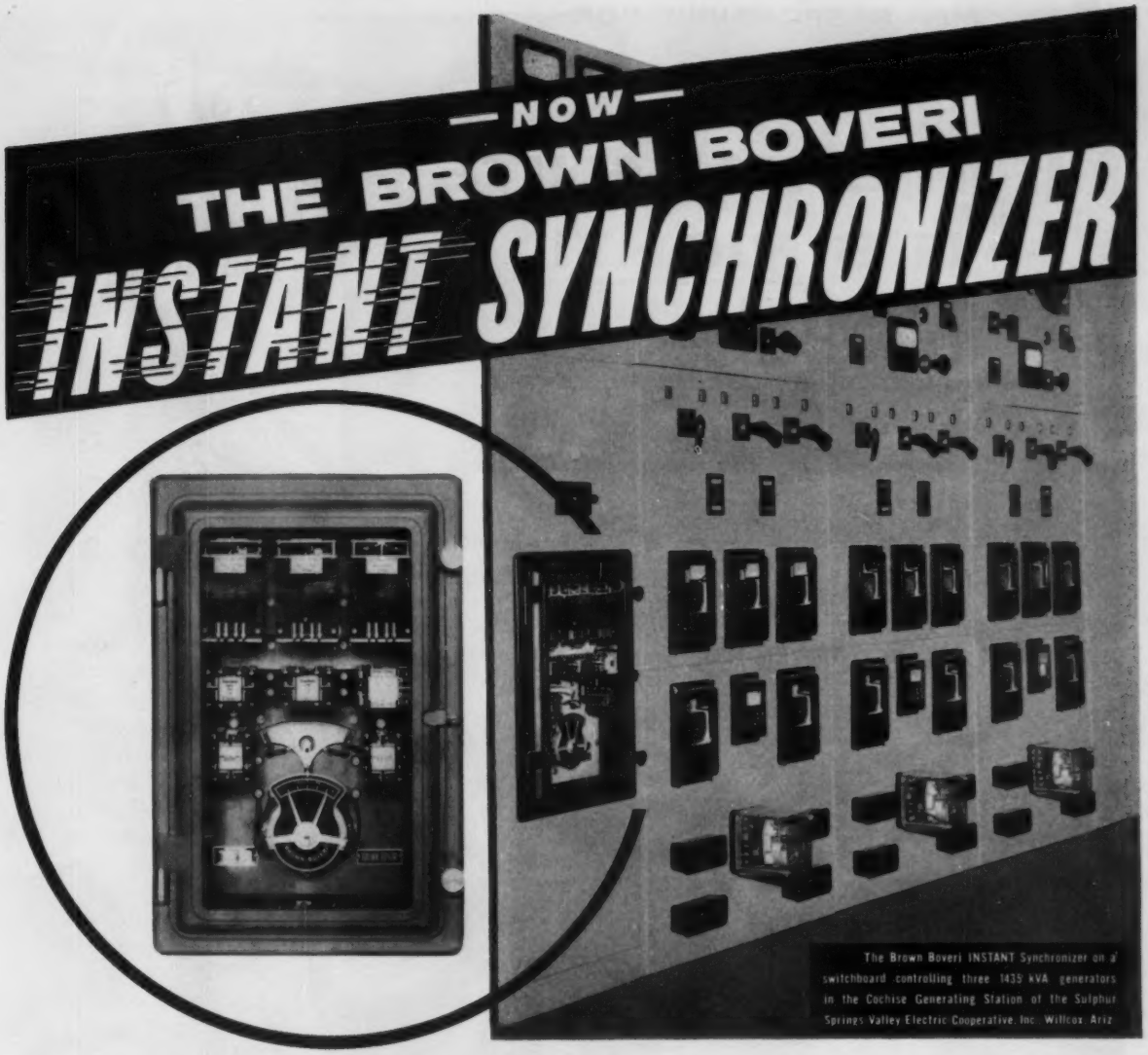


Station Type MP Dynagap arresters are available for operating voltages of 2.4 to 69 kv in 23 ratings or types. Thorex MP and MPR arresters generously exceed all Station Type requirements and are identical in every characteristic except physical shape. MP construction, as shown, is used up to 69 kv. Above this point, the height-saving MPR design is supplied.



— NOW —

THE BROWN BOVERI INSTANT SYNCHRONIZER



The Brown Boveri INSTANT Synchronizer on a switchboard controlling three 1435 kVA generators in the Cochise Generating Station of the Sulphur Springs Valley Electric Cooperative, Inc. Willcox, Ariz.

THE Brown Boveri INSTANT Synchronizer provides unusually fast, fully automatic speed-matching and synchronizing.

First, it automatically matches the speed of the generator to the system. When the frequency difference is .5 cycles or less (which limits paralleling shock), the Synchronizer computes the proper lead time to activate the breaker so that its contacts will make at the exact *instant* of phase coincidence . . . and paralleling occurs instantly without the necessity of actually holding synchronism.

The INSTANT Synchronizer uses no tubes or transistors, and under severe operating conditions, may remain set up for hours without risk.

If you are interested in fast fool-proof synchronizing, fill out and mail the coupon for more details. *Do it Now!*

MAIL COUPON TODAY!

Brown Boveri Corp., 19 Rector St., N. Y. 6
Send complete details about INSTANT Synchronizer.

Name..... Title.....
Company .....
Street .....
City..... Zone.....
State.....

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BROWN BOVERI

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POWER DISTRIBUTION KNOW...

IF IT'S PARANITE IT'S RIGHT!®

FROM AERIAL TO UNDERGROUND CABLE...

Paranite has a cable specifically engineered to meet your most rigid requirements! Super-Pararite® butyl rubber insulations have been developed to withstand special conditions in *your* area. Copper or aluminum bare or weatherproof cables — ACSR or line wire (formerly products of Midland Wire Corporation) are available.

PARANITE WIRE AND CABLE

DIVISION ESSEX WIRE CORPORATION

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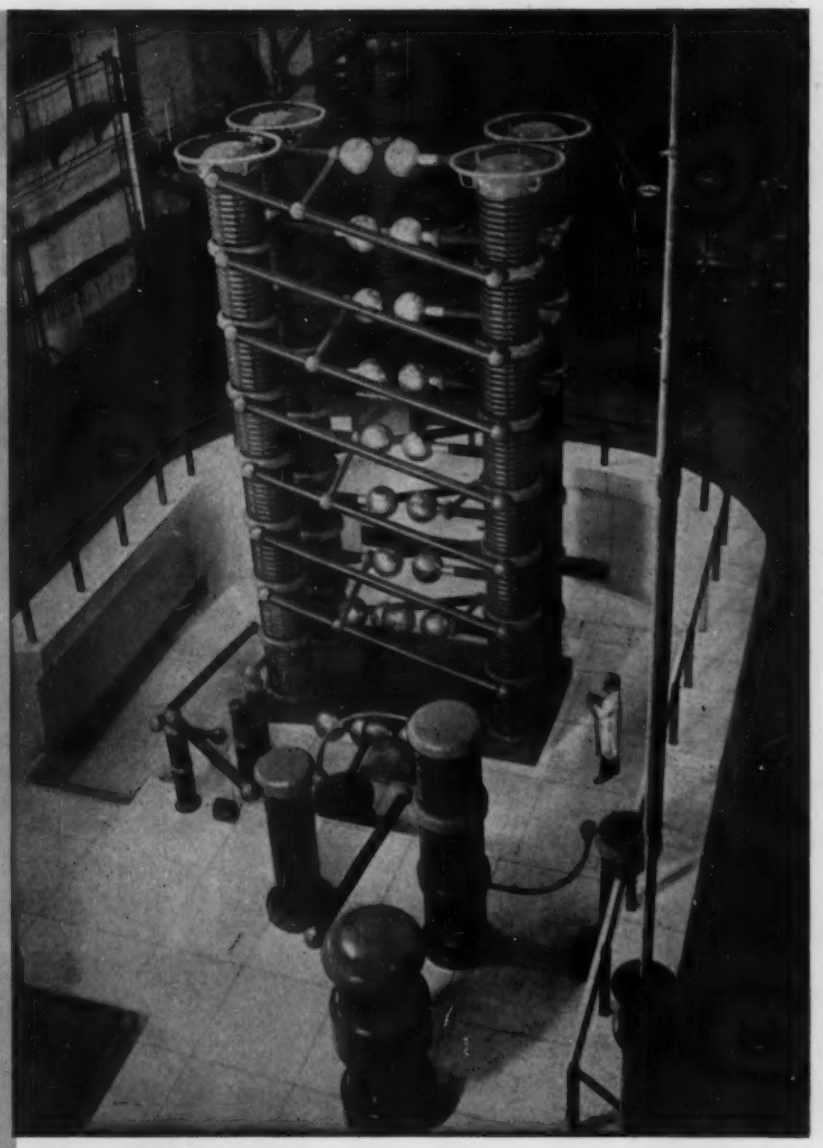
Transformer Capacity of over 5,000,000 kVA per annum

The Ferranti transformer plant at Hollinwood, Lancashire, England, covering an area of over 300,000 sq. ft., has a manufacturing capacity per annum of over 5,000,000 kVA of Large Power Transformers, Distribution Transformers, Voltage Regulators, High Voltage A.C., D.C., and Impulse Testing Plant and Specialised Equipment. Contracts include the supply of transformers for the Garrison Dam and McNary Dam Projects in the U.S.A. and the Alcan Project in Canada.



National Physical Laboratory

This Ferranti Impulse Generator at the National Physical Laboratory, Teddington, England, by whose permission the photograph is reproduced, generates 3,200,000 volts and has an energy rating of 77 kW seconds. This is a typical example of the type of A.C. and D.C. equipment manufactured by Ferranti Ltd., for routine and research testing.

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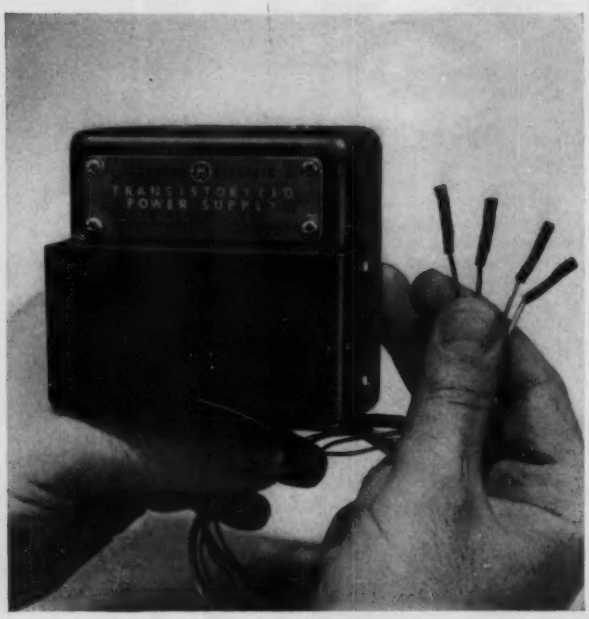
General Electric announces

New transistorized power supply for two-way radio



General Electric now brings you the vastly improved reliability of transistors — *without obsoleting your present equipment!*

The all-new General Electric Transistorized Power Supply—part of G.E.'s advanced Progress Line—replaces the receiver portion of the mobile power supply and eliminates the receiver vibrator.

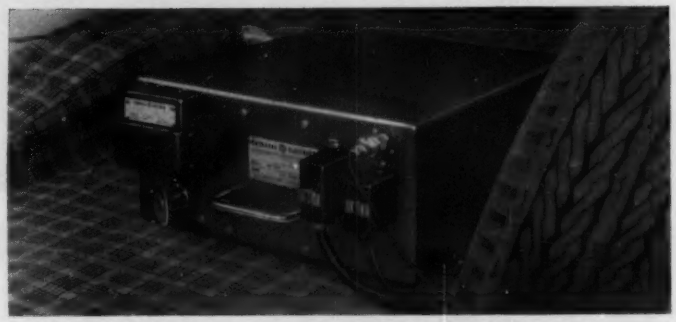
Here's what this means: Previously you had to replace receiver vibrators several times a year. Our surveys indicate each replacement costs you from $10 to $18, depending upon service call mileage. Now you can install a power supply costing only $54.50 (when installed in new equipment at the factory, just $44.50) which has the same life expectancy as your entire mobile combination. *The new G-E Transistorized Power Supply will easily pay for itself the first year or two on vibrator replacements and service calls!*

Easy to install—Three mounting studs fasten the new unit to the front of your case or inside the older, two-unit design equipment. Electrical connections are simple: only four leads to attach.

Eliminates "Vibrator Hash" — All traces of the "vibrator hash" which interferes with clear reception are gone for good.

Easily added to any 12-volt system — The new power supply can be used with all standard makes of two-way equipment which operate from an ordinary 12-volt power source.

Saves you money when drivers forget—When drivers neglect to turn off their radios before starting a vehicle, the new transistorized power supply cannot be damaged.



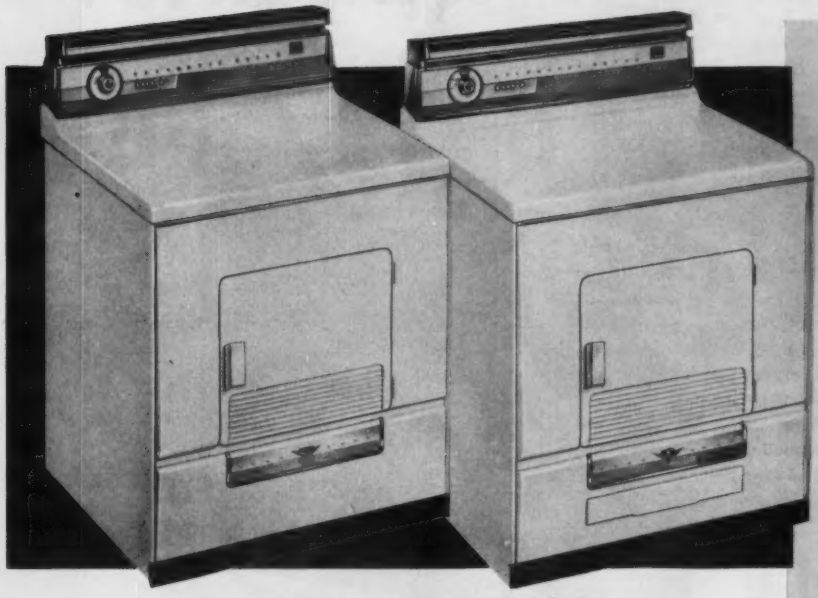
Progress without obsolescence — The addition of the new unit to your present mobiles, no matter what make, improves performance, reduces maintenance cost, and adds to the life of your equipment. *There is absolutely no need to buy complete new mobile units to enjoy the advantages of transistors.*

See for yourself how much you save—buy a new unit or several units and try them in your own 12-volt mobile units. Call your G-E communications consultant, listed under "Radio Communication Equipment" in the Yellow Pages. Or order direct by writing General Electric Co., Communication Products Dept., Syracuse, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Important to Utility Revenue!
there's a Hotpoint
Automatic Dryer To Fit Every Demand



Because automatic clothes dryers use an average of over 750 Kilowatt hours annually—*almost entirely concentrated in off-peak hours*—the clothes dryer load is becoming more and more important to utilities.

Here's the line of clothes dryers that helps you build this profitable load by surrounding every prospect with more reasons to buy. Hotpoint offers *two* types of Automatic Electric Clothes Dryers, in *seven* great new models.

There are three Sealed Chamber models that need no venting, and four Air-Blower Models with giant lint screen. A model for every need, every budget . . . and each is loaded with Hotpoint's famous pre-sold quality and convenience features that help you sell with a minimum of effort.

Your Hotpoint Distributor has the complete story on the widespread merchandising, acceptance and feature versatility of Hotpoint Automatic Dryers. Why not see him *today?*

Two Types—Seven Models

Hotpoint

Sealed Chamber Dryers
Three Models

No venting required! Ideal for installation in either utility room or kitchen. Purified, heated dry air takes moisture and lint from clothes. Cold water spray condenses moisture, and lint and water are pumped down the drain.

Hotpoint

Air-Blower Dryers
Four Models

Plug-in flexibility! One connection for either 115V or 230V operation. Hotpoint quality and convenience features, in a low price Air-Blower Dryer. Air-Blower models have giant Wide-Screen Lint Filter for increased drying efficiency.

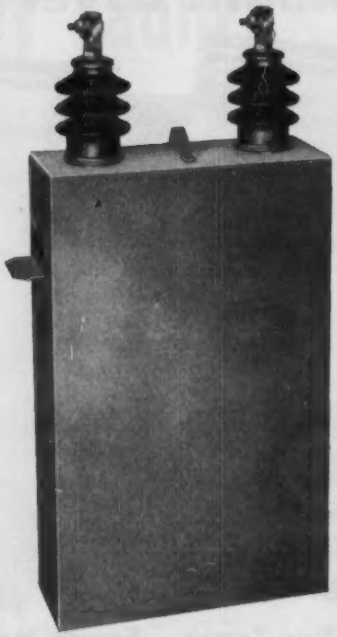
Hotpoint Automatic Electric Dryers put more *salespower* behind "HOUSEPOWER"—more *living* in "LIVE BETTER . . . Electrically"!

Again, Hotpoint looks at Tomorrow, Today!

CLOTHES DRYERS • AUTOMATIC WASHERS • RANGES • REFRIGERATORS • DISHWASHERS • DISPOSALL® • WATER HEATERS • FOOD FREEZERS • AIR CONDITIONERS • CUSTOMLINE • TELEVISION

HOTPOINT CO. A Division of General Electric Company, 5600 West Taylor Street, Chicago 44, Illinois

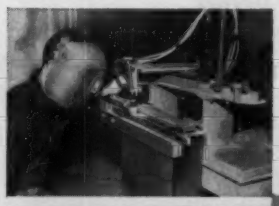
TOBE...tomorrow's certainties out of today's experiments!



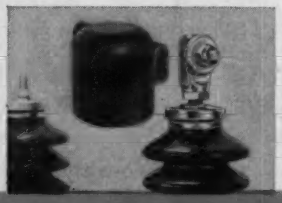
CAPACITOR PROGRESS does not start in the laboratory. It has its origin in the needs of utility companies. TOBE translates those needs into the research that makes tomorrow's progress possible.

RESULT: progressive engineering of the type that has *resulted in* the famous TOBE 50-KVAR capacitor . . . *In* a stainless steel container at no extra cost . . . *In* low losses that mean more correction for less dollars . . . *In* design and processing procedures that assure thermal stability over the entire operating range. Yes, it will pay you to investigate TOBE TEMPALL power capacitors today! Write Tobe Deutschmann Corporation, Norwood, Mass. or call Norwood 7-2620, collect—for further information on power capacitors today.

HERE'S WHY BETTER POWER CAPACITORS COME FROM TOBE—

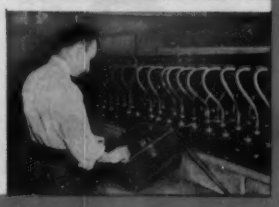


Heliarc weld virtually seamless stainless steel container.



One piece wet-process solder-sealed porcelain terminals equipped with self-locking neoprene caps.

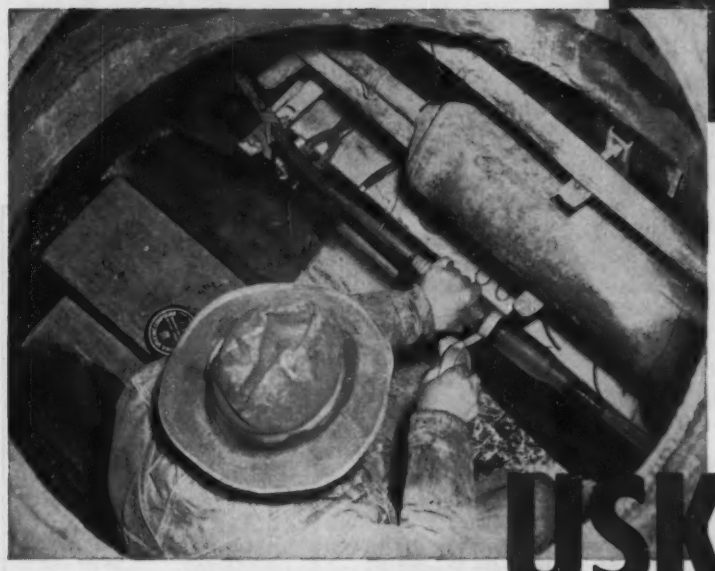
Special TOBE assembly control mechanism results in greater product uniformity.



Another TOBE exclusive: checks on each capacitor during every step of processing.

Look to TOBE for progress. Since 1929 persistent research, trustworthy engineering, rigid production standards.

Overhead or Underground



There's never a breakdown with USKORONA tape

On splicing or terminating electrical cables on underground power lines, street lighting circuits and transformer leads, on secondary network systems—to name just a few—Uskorona tape is *essential* because it is the only tape that is resistant to both ozone and moisture. It fuses with and becomes a part of the insulation and gives the same dielectric strength as the original insulation. Naturally, it exceeds A.S.T.M. specifications.

Uskorona® was developed to assure ozone and moisture protection to high voltage lines. Here's how good Uskorona is:

- In a corona-(ozone) resistance test of 4 leading brands, Uskorona was the only tape still intact after 4 hours of exposure.
- Even after 1500 additional hours of continuous exposure, Uskorona remained as fresh and corona-resistant as at the start.

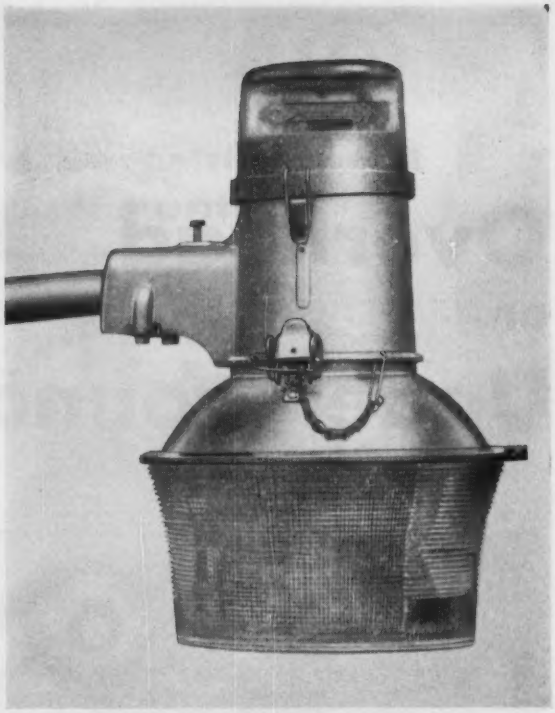
Obtainable at any of our numerous distributors, any of the 28 "U. S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.

Mechanical Goods Division

United States Rubber

L-M Suburbanaire Gives Protection, Adds Off-Peak Load

Utilities rent customers this photocell-controlled luminaire at about $3 a month; it provides all-night lighting for security and recreation; increases revenue for the utility. Open-type refractor keeps maintenance at minimum.



A number of utility companies have had excellent results with a new plan for individual outdoor lighting for customers. Here, briefly, is the plan:

- The utility installs the L-M Suburbanaire on the customer's premises without charge. The Suburbanaire is an open-type, low-cost luminaire with built-in photocell control, thus providing all-night yard lighting.
- The utility maintains the unit and keeps it in operation.
- The utility provides power which does not go through the customer's meter.
- Cost to the customer is a stated amount per month—usually $3 or $3.50—which covers all costs. The utility retains ownership of the luminaire.

Customers like the plan, because it safeguards property, cuts vandalism and theft, reduces accidents, and has some prestige value, particularly in areas where there is no street lighting.

From the utility standpoint, the plan increases revenue in off-peak hours. Here is what some utility men say:

"We have installed more than 200 L-M rural lights, increased our off-peak load by more than 50 kw, and have had many expressions of complete satisfaction from our customers."

"The Photocell Suburbanaire assures us of an off-peak load of about 1000 kw hours per unit. We have installed almost 400 Suburbanaire luminaires, many of these replacing the old makeshift radial fixture arrangement. Customer reaction has been excellent . . . equipment and gasoline theft has dropped substantially and vandalism is almost nil."

"From time to time, customers have asked us for outdoor lighting for rural and suburban homes. Since January, 1957, we have been installing L-M's new Suburbanaire unit. The long-life lamp and photo-electric cell, plus ease in relamping and cleaning the open refractor, will keep our maintenance costs at a very low minimum. This makes it possible to offer this service at a very low cost."

TYPICAL ANALYSIS OF COSTS

Material:	
Suburbanaire, photocell, bracket, etc.	$ 70.00
Installation labor	30.00
Annual power cost (based on 300 watt lamp burning 4000 hrs. per year @ 1¢ kwh)	12.00
Lamp replacement, maintenance	9.00
Total Cost First Year	**$ 121.00**
Outdoor lighting equipment is built to last 20 to 25 years, but if this equipment is amortized over 10 years, the cost will be:	
First-year cost (above)	$121.00
Nine times power and maintenance cost (9 more years) 9 x ($12 + $9)	189.00
10-year total	$310.00
Interest at 6%	18.60
Profit, at 10% on $328.60	32.86
Total 10-Year Cost Plus Profit	**$ 361.46**
Annual cost (1/10th)	$ 36.15
Cost per month (1/12th)	$ 3.01

Get The Whole Story

Ask the L-M Field Engineer for bulletin on the L-M Suburbanaire luminaire and more information on the profitable customer-rental plan. Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

316

LINE MATERIAL Industries Outdoor Lighting

McGRAW-EDISON COMPANY

Outdoor Lighting

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Grand Rapids 5, Mich.	668 Rudy St., N. E.
Green Bay, Wis.	1119 Spence St.
Harrisburg, Pa.	2700 Paxton St.
Hartford, Conn. — Newington	P. O. Box 9
Houston, Texas	5715 Navigation Blvd.
Indianapolis 4, Ind.	814 Union Title Bldg.
Jackson 6, Mich.	1514 Daniel Road
Jackson, Miss.	608 Colonial Circle
Jacksonville, Fla.	1620 Holly Oaks Lake Rd.
Los Angeles 22, Calif.	6490 E. Fleet St.
Madison, Wis.	405 Tompkins Drive
Memphis 7, Tenn.	1169 Morehead St.
Miami 38, Florida	7240 N. E. 4th Ct.
Milwaukee 1, Wis.	700 W. Michigan St.
Minneapolis 20, Minn.	500 W. 79th St.
Nashville 4, Tenn.	1503 Laurel St.
New Orleans 22, La.	2860 Arts St.
New York 6, N. Y.	74 Trinity Pl.
No. Kansas City, Mo.	10th & Erie Sts.
Oklahoma City 5, Okla.	317 N. E. Hill St.
Omaha 3, Neb.	3415 Cuming St.
Philadelphia 2, Pa.	2416 Girard Trust Co. Bldg.
Phoenix, Ariz.	625 W. Madison St.
Pine Bluff, Ark.	1904 W. 31st
Pittsburgh 22, Pa.	535 Smithfield St., Oliver Bldg.
Portland 9, Ore.	1333 N. W. 12th Ave.
Raleigh, No. Carolina	216 Russ St.
Richmond 20, Va.	1717 Rhoadmiller St.
Roanoke, Va.	915 S. Jefferson St.
Sacramento 18, Calif.	1123 Teneighth Way
St. Louis 1, Mo.	1024 Title Guaranty Bldg.
Salt Lake City 10, Utah	980 S. 6th West St.
San Antonio, Texas	825 Majestic Bldg.
Seattle 99, Wash.	1220 W. Nickerson St.
Sioux City 4, Iowa	P. O. Box 443
So. Milwaukee, Wis.	12th & Madison Aves.
So. San Francisco, Calif.	360 Shaw Road
Spokane 24, Wash.	E. 3303 Ferry St.
Springfield, Ill.	504 E. Monroe
Springfield, Mo.	961 S. Weller
Syracuse 2, N. Y.	221 Erie Blvd. W.
Tampa 2, Florida	306 No. Newport Ave.
Union, N. J.	P. O. Box 306
Wichita 16, Kansas	1400 N. Charles
Zanesville, Ohio	Pershing Road

One Source Of Supply For All Your Outdoor Lighting Needs

Line Material offers a complete line of incandescent, mercury vapor, and fluorescent lighting equipment for all types of outdoor applications. In addition, L-M offers the most advanced operating systems and control equipment for lighting streets, airports, roadways, shopping centers, and parking areas.

Complete Engineering Assistance

To assist you in designing the best lighting system for your particular application, Line Material has an extensive field sales organization consisting of more than 150 engineers, including 10 lighting engineers, who will cooperate in every way possible. Nine factories, 70 warehouses, and 73 sales offices are further assurance that all your needs and requirements will be given immediate attention.

Get Complete Information

Contact the Line Material Street Lighting Engineer, or the Field Engineer nearest you, for more complete information and bulletins; or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

LM®

LINE MATERIAL Industries

McGRAW-EDISON COMPANY

McGRAW EDISON

Luminaires

L-M LUMINAIRES ARE BEST FOR YOUR STREET LIGHTING REQUIREMENTS

Line Material lighting specialists are available to help you plan any type of street lighting installation. L-M's Lighting Department is ever ready to help public officials plan a lighting system whether it be for a single block or for an entire community. The lighting specialists are backed not only by complete experience with L-M lighting equipment, but also a vast knowledge of all IES and NEMA practices and standards.

L-M offers the most advanced equipment and operating systems for incandescent, mercury vapor and fluorescent street lighting, whether it is for application in residential streets, or high-speed super highways. A few of the more popular types of L-M luminaires available are illustrated below.

FLUORESCENT LUMINAIRE — L-M's fluorescent luminaire, the ultimate in modern styling, is available in deep and shallow styles, either four or six feet in length, and is designed to accommodate present and future very high output (VHO) fluorescent lamps. In application, this modern fluorescent luminaire distributes the light over a broad area, giving good balance between buildings and road surfaces, and is intended primarily for street and highway lighting. For other outdoor lighting applications, such as parking lots, store front lighting, etc., other styles are available.

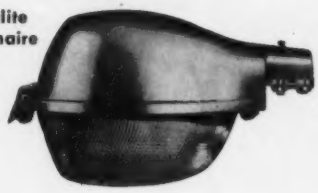
OVALITE® LUMINAIRE — L-M's Ovalite luminaire has been photometrically, electrically, and mechanically designed to meet todays many requirements for good street lighting. It provides IES Types II, III and IV medium, medium-wide and wide light distribution patterns and can accommodate mercury vapor lamps up to 21,000 lumens, and incandescent lamps up to 10,000 lumens. It has an eye-pleasing, modern appearance, and may be used for lighting busy downtown shopping and commercial areas, highways, and interchanges, and store fronts, parking areas, loading docks and railroad yards. This luminaire has many features which bear investigation.

SPHEROLITE® SR. AND JR. LUMINAIRES — The L-M Spherolite Sr., luminaire is designed for use with incandescent lamps up to and including 575 watts on multiple circuits, or 10,000 lumens on series circuits. Its high degree of effectiveness make it especially adaptable for low-cost lighting of business districts and principal routes of traffic. Light distribution patterns are provided in IES Types I, II, III, IV, V and 4-way Types I and II. The Spherolite, Jr., is a small shielded light source type unit, which is intended primarily for residential lighting where narrow streets and wide spacings prevail. It has strong, yet narrow beam characteristics which provide effective lighting for streets with proper cut-off for residential property. It provides IES Types II, V, and 4-way Type II light patterns.

L-M SUBURBANAIRE AND DIRECTOLITE LUMINAIRES — L-M's two open type luminaires place the efficiency of modern and scientifically controlled street lighting within the reach of smaller communities and in outlying areas of larger cities where high intensity is not required and where economy is a consideration. The open refractor Suburbanaire provides for excellent cooling, larger lamps and easy relamping, and has a pleasing daytime appearance. It is available in IES Type I, II, III, V and 4-way Type II light patterns. The Directolite luminaire is available with stainless steel asymmetric and symmetric reflectors which provide IES Type II and V light patterns. The stainless steel reflector has excellent lighting characteristics and produces a high utilization of light on street surfaces. Houses and street side shields are available for the asymmetric reflector.

▲ Fluorescent Luminaire

Ovalite Luminaire



Spherolite, Sr. Luminaire

Spherolite, Jr. Luminaire

Suburbanaire Luminaire

Directolite Luminaire

LM® LINE MATERIAL Industries
McGRAW-EDISON COMPANY

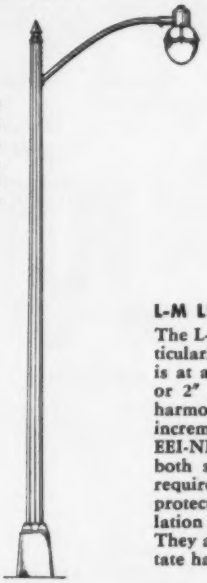
Supports · Accessories

L-M STREET LIGHTING ACCESSORIES

A full line of accessories to complete your street lighting requirements is available through Line Material Division. A representative group of this class of material is shown here.

STREET LIGHTING POLES ▶

Line Material furnishes a variety of street lighting poles to meet the requirements of all lighting installations. More complete data on aluminum, steel, and concrete poles, which are available through Line Material Company will be furnished upon request.

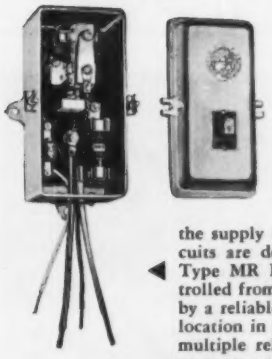


L-M'S TYPE CW CONSTANT WATTAGE BALLAST assures more uniform individual light output for mercury vapor street lighting systems. This lightweight, moisture-proof ballast offers an excellent voltage regulation and has outstanding sub-zero starting characteristics. The unit is easy to mount and presents no stocking problem since the same ballast may be used for pole base, pole top, or aerial application. ◀

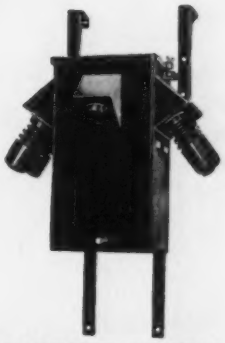
L-M LUMINAIRE SUPPORTS ▶

The L-M family of supports was designed to be particularly applicable for joint-use poles, where space is at a premium. They are available in either 1¼" or 2" pipe, in either steel or aluminum, in the four harmonizing models shown. They are made in 2-foot increments from 4 feet through 20 feet. All meet EEI-NEMA Standards (TDJ-137 and SH7-1956) in both strength and minimum pole space mounting requirements. All threaded parts of each support are protected with a plastic coating, and complete installation instructions are clearly marked on each support. They are all unit-packaged with steel bands to facilitate handling, shipping and warehousing.

L-M TABET PHOTOELECTRIC RELAYS are rugged, delayed action units which are designed specifically for street lighting control. They are comprised of a light sensitive photocell, a two-tube amplifier of proven performance and long life, and a power switching relay of high capacity and versatile design. The circuit provides delaying action to prevent false operation due to momentary incidental light changes. These photo-electric relays come in various models for crossarm or pole mounting, or in a weatherproof standard watthour meter case with a socket plug-in base.



RCOC REMOTE CONTROL RELAYS with 120-volt, 60-cycle operating coils and with load contacts rated for switching the supply to 120-volt AC street lighting circuits are designated as multiple relays. The Type MR Relay shown here is usually controlled from a pilot circuit which is energized by a reliable automatic control from a central location in a control area. A complete line of multiple relays are available with both load contacts normally closed or normally open. Voltage ratings other than 120-volt AC are available on request. ◀



RCOC MANUAL AND REMOTE CONTROL OIL SWITCHES are available for switching of the primary to transformers which energize outdoor lighting circuits. Shown here is the Type AN oil switch which is recommended for this type of application. ▶

Outdoor Lighting

McGRAW EDISON

Airport Lighting

LINE MATERIAL AIRPORT LIGHTING EQUIPMENT

L-M leads the field in development and application of airport ramp and runway lighting. Equipment includes high intensity fixed focus, and controllable Thermal Beam® runway lights, and medium intensity runway and taxiway markers, all of which are CAA approved. In addition, a "Flying Farmer" landing strip lighting unit is available in a complete 2000-foot to 3000-foot runway package for as little as $600.

L-M also makes available a fluorescent luminaire for ramp lighting. These luminaires provide a broad light source, with a high level of illumination with a minimum of glare to incoming pilots.

RUNWAY LIGHTS at Birmingham (Ala.) Municipal Airport are L-M's high-intensity units. L-M's units compensate in intensity and beam direction for fog and other low-visibility conditions.

L-M's 200,000 cp "low wing" Thermal Beam unit; CAA L-818.

1

Fixed-focus high-intensity runway light; CAA L-819

2

Medium-intensity runway and taxiway marker; CAA L-802 and L-822.

3

"Flying Farmer"® unit—complete 2000-ft. runway package for $600.

4

L-M fluorescent units, for ramps, roadways, and parking areas.

5

1. L-M 200,000 candlepower "low wing" Thermal-Beam unit is the solution to many of the more serious operating problems in high intensity airport lighting. It provides simplified automatic beam control by the tower operator and eliminates many items to give lower installation and maintenance costs. Made in accordance with CAA Specification L-818.

2. This fixed focus L-M runway and threshold marker light is designed to comply with CAA Specification L-819 for high intensity lighting on instrument runways. The unit is of simple construction requiring a minimum of maintenance and has good operational safety since it is less than 17" high and weighs only 7 pounds.

3. This elevated runway-taxiway marker light complies with both CAA Specification L-802 (elevated runway light) and CAA Specification L-822 (elevated taxiway marker light). The same fixture is used for both applications, the only exception being that an asymmetrical lens is used on the former and a symmetrical lens on the latter.

4. The L-M "Flying Farmer" runway light is a 15 watt, 25 candlepower unit, designed for operation on ordinary house current, 120-240 a-c or d-c. It is especially adaptable to private air strips and for use in Class I Airports, and is simple enough to be installed by the aircraft operator. The completely self-contained, ready-to-install Flying Farmer package is available for 2000-ft through 3000-ft runways.

5. L-M's 2-lamp fluorescent luminaire is especially adaptable to airport ramp lighting since the soft, non-glare light it provides is conducive to safe aircraft movement as attested to by commercial and private pilots. The unit is light in weight, easy to mount and demands a minimum of maintenance.

RAMP LIGHTING at General Mitchell Field's air terminal, Milwaukee, has 154 of L-M's high-efficiency fluorescent units. L-M's fluorescent luminaires provide a broad light source, high level of illumination with a minimum of glare to incoming pilots.

LINE MATERIAL Industries

McGRAW-EDISON COMPANY

Outdoor Lighting

you will be on safe ground with . . . . . .

WEAVER
GROUNDING DEVICES

Economical prices—ease of installation—trouble-free service . . . all yours with Weaver grounding devices!

GROUND RODS AND CLAMPS

They're designed for each other! RODS are completely copper armored . . . safe from corrosion. Rigid steel core and sharp point make driving easy. The CLAMPS grip firmly . . . hold connections under extreme pressure permanently. Rounded screw point prevents rod damage.

POLE BOTTOM GROUND PLATES

. . . have 25% larger copper area than other commonly used plates. That means: greater conductivity—better overload dispersal. Solderless connector with vibration-proof lock washer assures high pressure contact that stays tight *for keeps.*

GROUND CLAMPS (UL APPROVED)

Cast in bronze for complete resistance to rust and corrosion. They're easy to use and make permanent ground connections. The only complete line of bronze clamps for ¼" to 4" pipe. Competitively priced.

WRITE TODAY FOR SAMPLES AND CATALOG

J. A. WEAVER Company

2110 HOWARD ST. • ST. LOUIS 6, MO.

Telephone CEntral 1-8100

Another new development using

B.F.Goodrich Chemical *raw materials*

This new telephone distribution wiring with insulation of Geon polyvinyl materials is manufactured by Whitney-Blake Company, New Haven, Connecticut.

He has the right number for new phones

THIS new telephone distribution wire, using copper conductors insulated with Geon polyvinyl materials, is cutting "hook-up" costs for new service *as much as 50%*.

One of the advantages of this new wire, in addition to the lower installed cost, is the ease with which the installer can tap into the color-coded wires anywhere along the line. This distribution wire permits telephone companies to supply almost immediate service in urban development areas, and the wire can be re-used after the installation of permanent cable plant.

This new development is practical because of Geon polyvinyl chloride's superior electrical properties, excellent resistance to abrasion and weathering. Even total immersion in water or oil for *years* won't break down Geon materials. As a result, Geon is the recognized leader in plastic insulating materials.

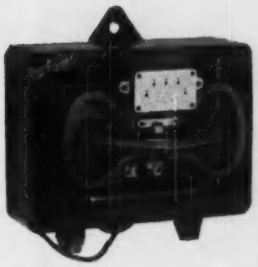
You can use the remarkable properties of Geon polyvinyl materials in many totally different products . . . rigid piping or flexible wall covering, foam padding or coatings for paper, textiles, or metal. For information write Dept. GE-1, B. F. Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

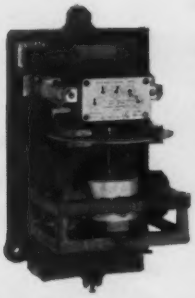
B.F.Goodrich — GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

Do you have "MUSEUM" METERS on your system?

The meters shown are from Sangamo's Museum of Metering.

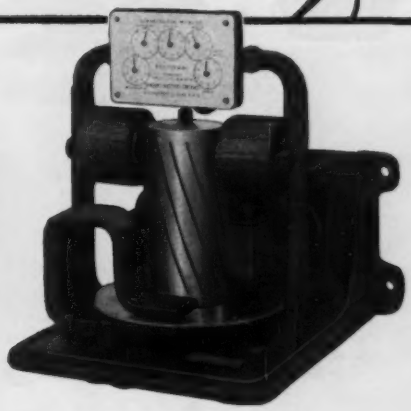


STANLEY A. C. WATTHOUR METER—1902. First meter to utilize principle of magnetic suspension. Sold for $10.00



THOMPSON A. C. WATTHOUR METER—1898. First induction type meter manufactured by Thompson which superseded his commutator type meter. Sold for $14.00

SHALLENBERGER A. C. WATTHOUR METER—1894. First commercial true energy measuring meter of the induction type. Sold for $15.00



GUTMANN A. C. WATTHOUR METER—1899. First A. C. Watthour meter manufactured by Sangamo Electric Company. First meter to utilize slotted armature to cause induced current to move sidewise. Sold for $11.25

More than 15,000,000 meters now in service are obsolete*

Surveys indicate that in addition to the millions of totally inadequate 5 amp. 2-wire meters still in service, there are another 11,000,000 meters of the "doubtful" category on utility company lines.

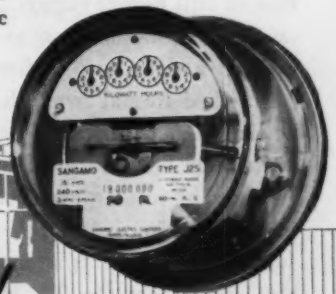
These "museum" meters are spinning at top speed in a hopeless effort to keep on measuring today's residential loads.

Carefully planned meter retirement programs are the wise answer to the problem. And the wise investment in replacement meters is the Sangamo J2—the watthour meter built to handle today's loads . . . *and* the loads of the future.

The Sangamo 15 ampere J2 meter incorporates the most advanced features of modern meter design to offer:

• *Straight line accuracy to 100 amperes* • *Corrosion-resistant construction* • *High torque, lifetime bearing system* • *High insulation level* • *Slow disc speed*

*These figures are based on surveys published in Electrical World. "LOADS OF THE FUTURE AND METERS OF THE PAST" has been reprinted for your convenience by Sangamo. Drop a postcard or a note for your copy of these surveys.



JH 57-8

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

When substation design calls for buses to withstand high fault currents, there's often considerable economy in use of insulators of high cantilever strengths. Availability of such insulators affords freedom in structure design, and reduces total number of insulators and points-of-support required.

In the illustration above, the insulators shown are, in order, a Lapp Standard Station Post, a Lapp High Strength Station Post, a Lapp Extra High-Strength Station Post, and a "special" Lapp Station Post of still higher strength. It's "special" only because it doesn't happen to be in the most recent catalog, and because it doesn't fit any previously-established formal strength standards. A customer needed 10,000 lb. cantilever strength in a 23-Kv switch and bus insulator. He got it—in a hurry. If you need an insulator of such characteristics, specify it as Lapp No. 41398. If you need switch-and-bus supports in any other strength rating, we can probably make them, too. The merit of the Lapp Station Post design is reflected in the ease of its stress analysis. The simplicity of the post structure, the uniform reliability of Lapp porcelain, and the certainty of externally-attached caps—instead of pins or inserts—all are such that it is routinely possible to design an insulator into an unexplored strength field, without risk of unknown variables.

At any voltage rating, in any strength class, Lapp Station Posts give you an *extra* margin of operating security, low upkeep, long life.

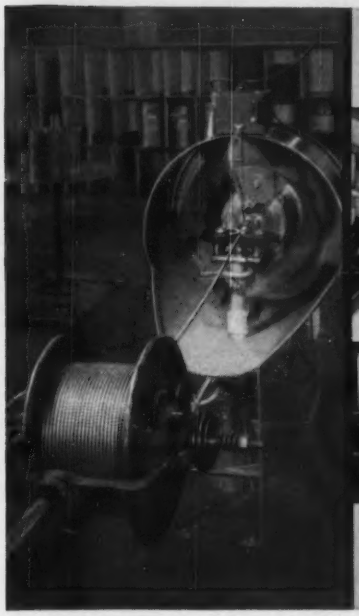
Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

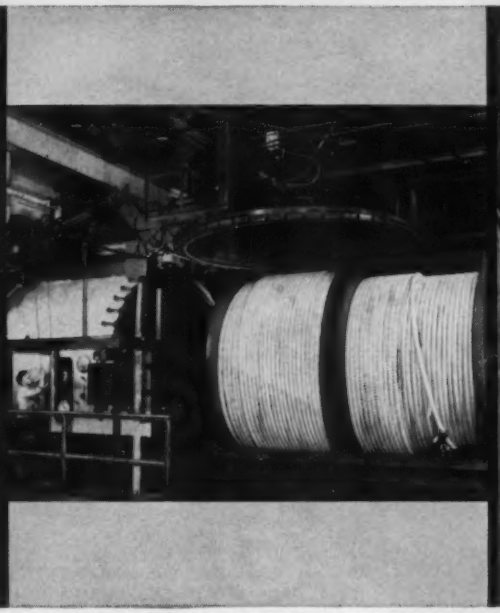
GENERAL CABLE

PAPER INSULATED
VERSATILE · RELIABLE
POWER CABLES

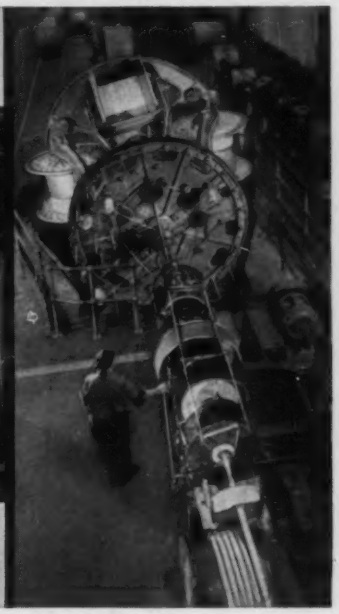
Manufactured at BAYONNE, N. J. • ST. LOUIS, MO. • EMERYVILLE, CALIF.



This machine forms steel strip into helical coil ducts or channels for use in gas filled or oil filled cable.



Impregnating Tank utilized in the heat-vacuum drying and oil impregnation steps in the manufacture of Paper Power Cable.



Large Cabling Machine used in cabling individually insulated conductors into multiple conductor assemblies.

- **SOLID TYPE**
- **LOW PRESSURE GAS FILLED**
- **LOW PRESSURE OIL FILLED**
- **PIPE TYPE**
  - **High Pressure Gas Filled**
  - **High Pressure Oil Filled**

The excellent operating record over many years and the superior electrical characteristics of paper insulated cable highly recommends its use for all power applications. Paper Power Cable is a predominant type in preference and use for voltages above 5 KV.

General Cable Corporation is equipped with the finest modern facilities for paper taping and with many years of know-how is in a position to supply a high quality product for all low and high voltage applications.

GENERAL CABLE CORPORATION
420 Lexington Avenue, New York 17, N. Y.
Offices and Distributing Centers Coast-to-Coast

for quality and economy... **specify GENERAL CABLE**

Shown here, inspecting Kansas City Power & Light's new Mobile units are, left to right: I. C. McLain, RT&E representative; R. L. Wright, E. D. Church and F. D. Cochran of Kansas City Power & Light.

KANSAS CITY POWER & LIGHT MAINTAINS SERVICE WITH RT&E EQUIPPED MOBILE UNITS

When necessary repairs must be made to Kansas City Power & Light's line installations, there's no shut-down on power to customers. Mobile substations like these are wheeled into action, taking over the transformer job while replacement or repairs are made on line units. Service is maintained without interruption.

The heart of these mobile substations depends on versatile RT&E DUAL VOLTAGE TRANSFORMERS . . . rated at 100KVA, 2400x7620 — 120/240/277 volts with *Externally Operated Taps* at 8000/7810/7430/7200 volts. These special units also incorporate RT&E's *Externally Operated primary voltage change-over switch.*

This is just another example of RT&E transformers at work, proving again their merits with many of the industry's outstanding and exclusive features.

EXCLUSIVE WOUND CORE
"WEATHER PROTECTED" DESIGN
EXTERNALLY OPERATED CHANGE-OVER SWITCH
EXTERNALLY OPERATED TAPS
FIVE YEAR GUARANTEE

Ask your RT&E representative to demonstrate the five sound reasons why RT&E transformers are better. Or write RT&E Corporation, Waukesha, Wisconsin.

RT&E CORPORATION WAUKESHA, WISCONSIN

HELPING PROVIDE POWER FOR AMERICA

Giant over-the-horizon antenna designed by Bell Telephone Laboratories for "White Alice," Air Force Alaskan defense communications network.

How UHF radio got seven-league boots

THE huge antenna systems which project ultra-high frequency radio communications beyond the horizon began when a Bell Telephone Laboratories engineer became intrigued with a strange phenomenon. Although these radio waves were supposed to be useful only over line-of-sight distances, the waves displayed a mysterious tendency to take off in a giant stride to antennas beyond the horizon.

This phenomenon had been studied both here and abroad, but no practical use was seen until the engineer became interested and thoroughly sifted the experimental data. He came up with the stimulating conclusion that over-the-horizon transmission is far stronger and much more dependable than was generally supposed. Further he predicted that it could be utilized to supply dependable broadband communications. He and his associates at Bell Laboratories confirmed the prediction experimentally, then drew up requirements for the first over-the-horizon UHF transmission system.

This pioneer work at Bell Telephone Laboratories has greatly increased the usefulness of UHF communications. For example, over-the-horizon transmission now provides critically important communications between remote military outposts in the Arctic and in the far north.

For the Bell System it can provide important new links for telephone conversations and television.

Kenneth Bullington, B.S.E.E., University of New Mexico; M.S., Massachusetts Institute of Technology; recipient of the 1956 Morris Liebmann Memorial Prize and the 1956 Stuart Ballantine Medal for his contributions in the field of over-the-horizon ultra-high frequency radio transmission.

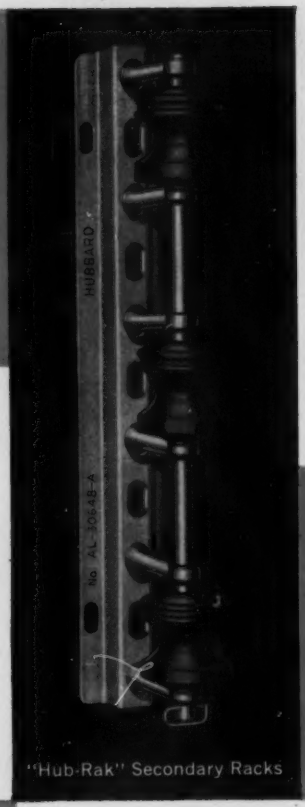
Experimental antenna used in early over-the-horizon UHF radio transmission research. Research extended transmission from 30 miles line-of-sight to 200 miles.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

Conductor Clamps

Lamp Lead Brackets



"Hub-Rak" Secondary Racks

Thimbles

Insulated Clevises

Guy Protector

Pole Markers

Underground Racks & Hooks

HUBBARD aluminum hardware cuts corrosion costs

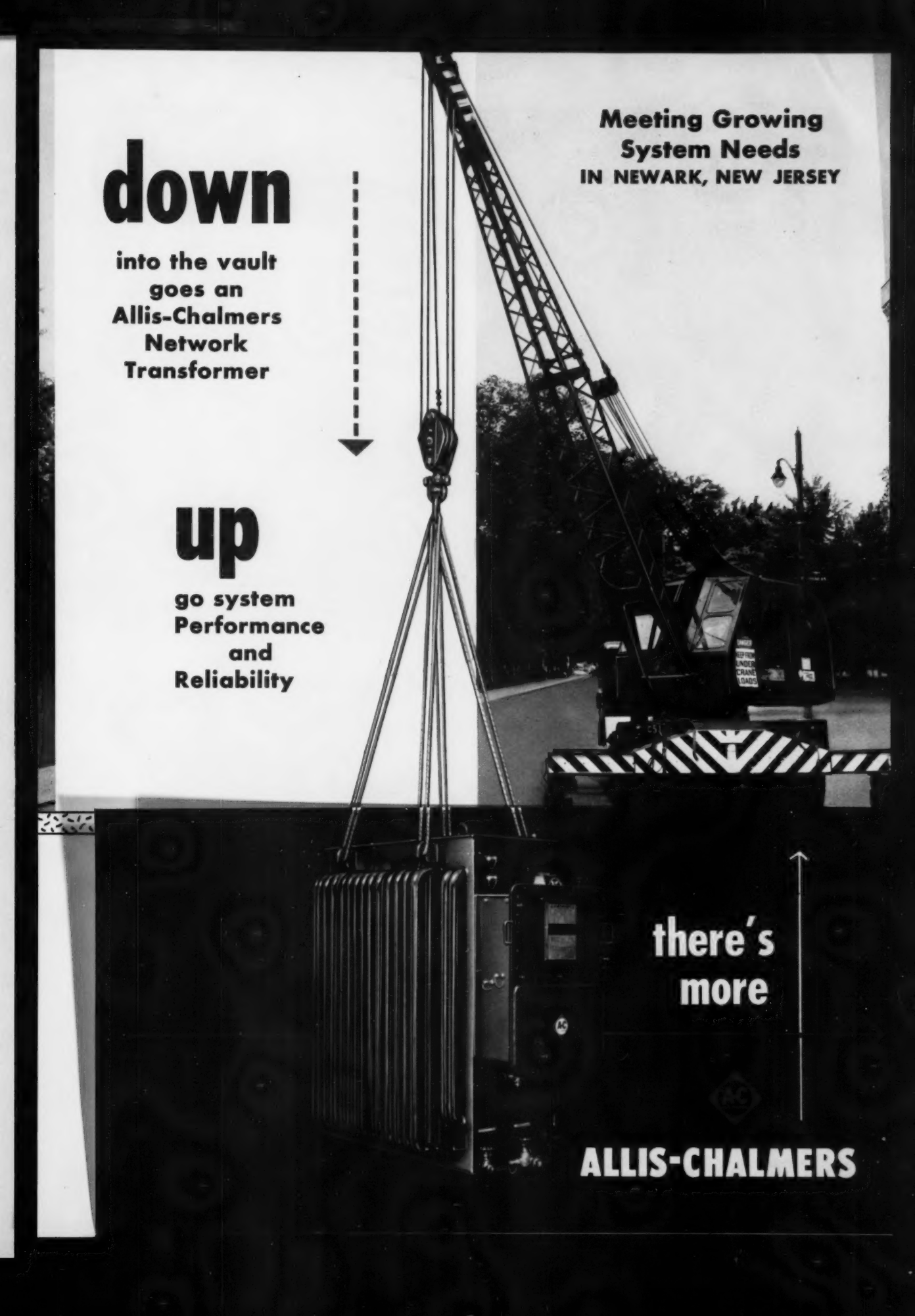
If you are faced with mounting corrosion costs in your service area, it will pay you to investigate Hubbard Aluminum Pole Line Hardware. This constantly growing line of hardware items was especially developed for application in corrosive atmosphere. To accomplish this, Hubbard combined the corrosion resistance, lightness and strength of special Aluminum Alloys with new fabricating techniques to produce hardware capable of long service life under extremely adverse conditions.

The special conditions of contamination in your area as well as other factors can be successfully overcome by the right choice of Pole Line Hardware Material. In addition to Aluminum Alloy, Hubbard Pole Line Hardware items are available in galvanized steel, Cor-Ten steel and special items in Copperweld steel. A Hubbard Hardware specialist will be glad to make a study of the atmospheric conditions which affect the service life of your pole line hardware in order to provide you with the type of hardware best suited to your needs.

LIVE BETTER ELECTRICALLY

HUBBARD AND COMPANY • 6301 BUTLER STREET, PITTSBURGH 1, PA.

Chicago, Ill.
Oakland, Calif.
Plano, Texas

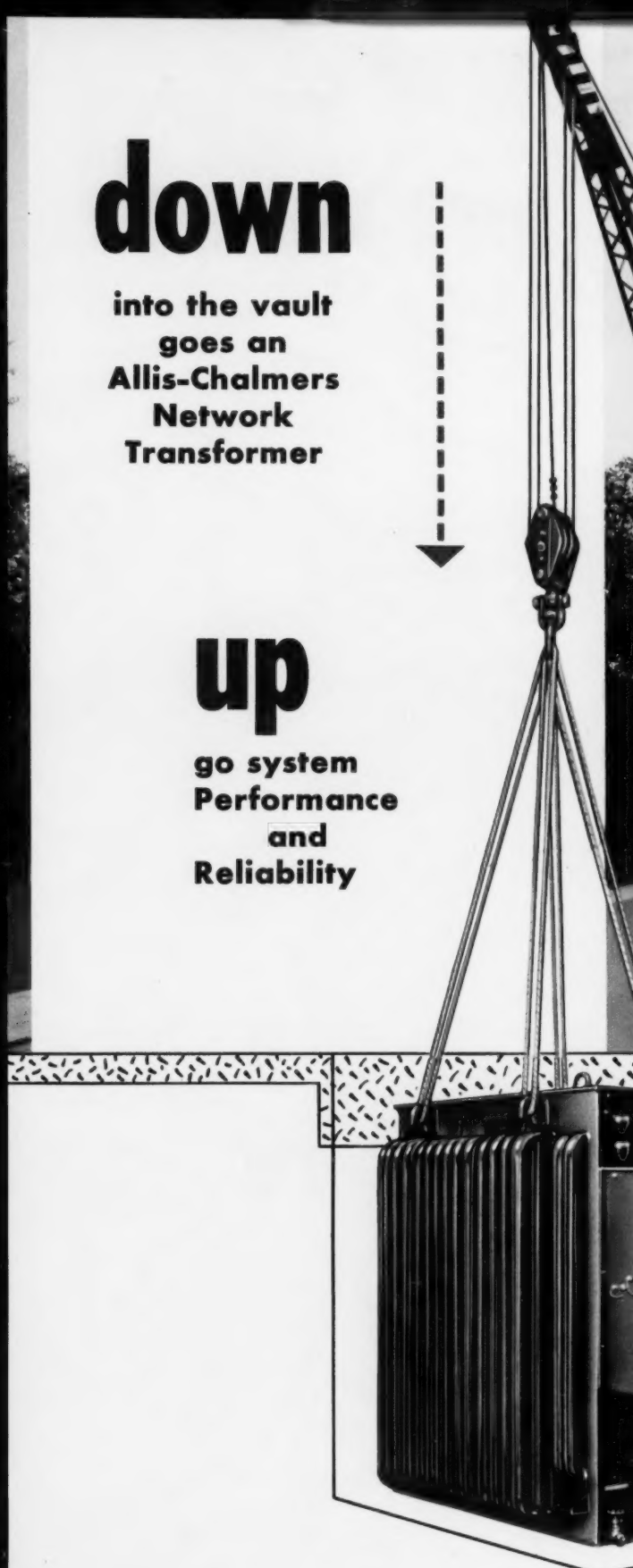

Meeting Growing
System Needs
IN NEWARK, NEW JERSEY
down
into the vault
goes an
Allis-Chalmers
Network
Transformer
up
go system
Performance
and
Reliability
there's
more
ALLIS-CHALMERS

down

into the vault
goes an
Allis-Chalmers
Network
Transformer

up

go system
Performance
and
Reliability

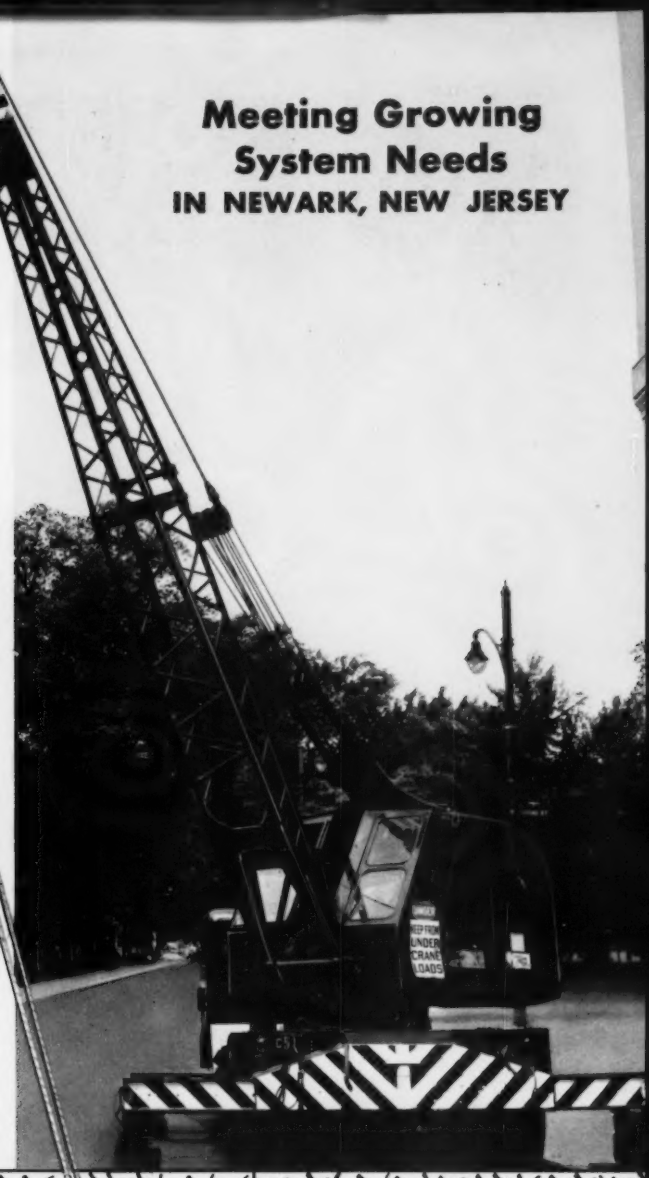


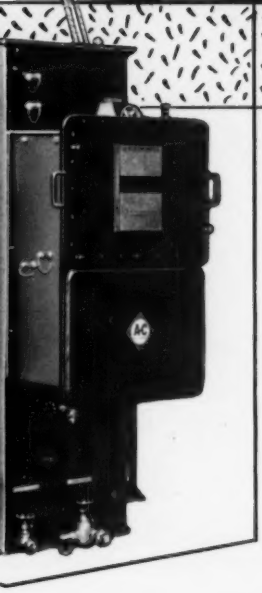
ALLIS-CHALMERS NETWO
The Choice of Utility E

Air conditioning and other power demands are putting a squeeze on downtown network systems in city after city. To meet these acute load-concentration needs, Allis-Chalmers network transformers are being installed on many of the most important systems in the country. This wide acceptance, based on an outstanding record of performance, is your assurance of complete satisfaction when you modernize or expand with Allis-Chalmers power equipment.

ALLIS-CHA

Meeting Growing System Needs
IN NEWARK, NEW JERSEY





WORK TRANSFORMERS—
Engineers Everywhere

To Meet Your Growing System Needs

It will pay you to investigate the many advantages of Allis-Chalmers network transformers . . . advantages that have merited the confidence of utilities and consultants everywhere. Get all the facts. See your Allis-Chalmers representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

HALMERS

A-C ALLIS-CHALMERS

A-5371

details...details...details

add Years to Transformer Life

Special Design of Bushing Seal

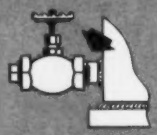
Spiral-wound metallic gaskets adjust to changing operating conditions . . . can be installed without grease or cement.

Protected Against Corrosion and Flooding

Tank surfaces are shot blasted and given three coats of baked-on phenolic base paint. Base and tubes are treated with a protective compound.

Major Gaskets Eliminated

Main cover and switch compartment are welded to tank. Oil sludging and oxidation are minimized.

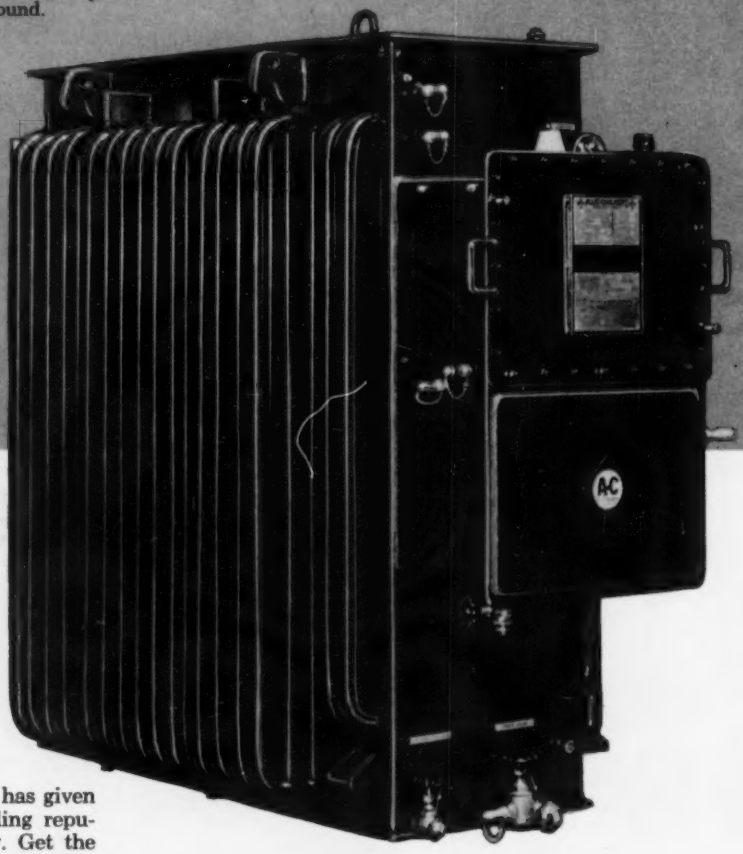


Threaded Valve Connections

Connections are solder wiped for extra protection. Valves are located for easy access. Globe-type valves with nonrotating seats close tight, avoid wear on the valve seat.

ALLIS-CHALMERS

NETWORK TRANSFORMERS



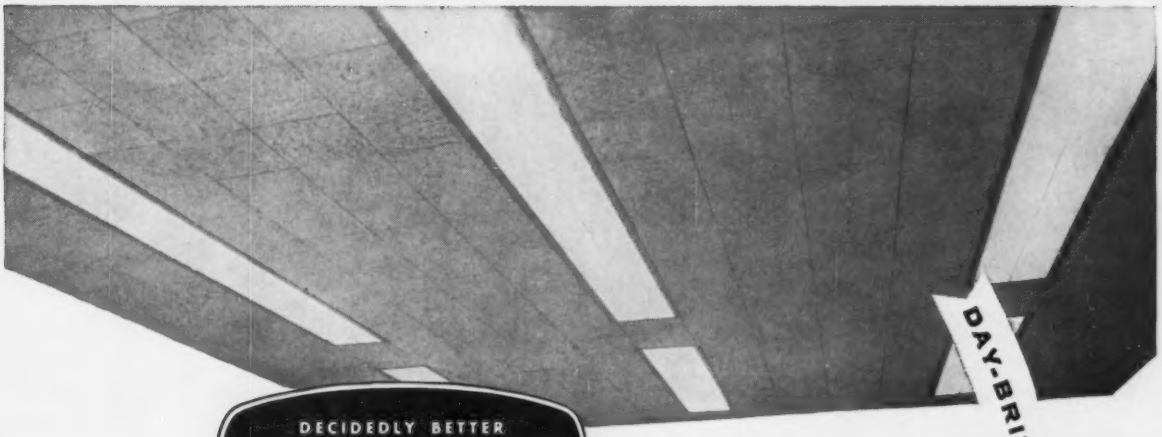
Compact, Low-Loss Design—

Thermal capacities are high for contingency load conditions. Liberal ducts throughout both high voltage and low voltage coils assure ample circulation of cooling liquid.

Attention to detail, as exemplified by many design, construction and easy-maintenance features, has given Allis-Chalmers transformers an outstanding reputation for performance and reliability. Get the complete story. See your Allis-Chalmers representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS



DECIDEDLY BETTER
DAY-BRITE
Lighting Fixtures

DAY-BRITE LIGHTING MAKES THE BIG DIFFERENCE HERE

Office efficiency demands Day-Brite lighting

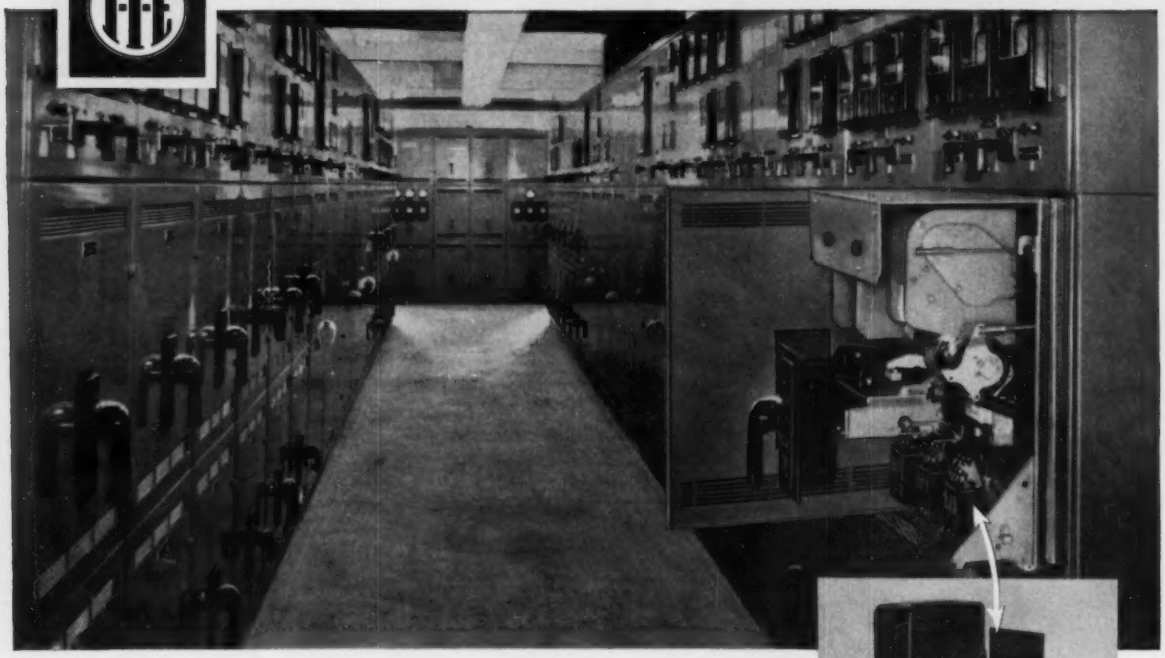
When a company spends thousands of dollars on new offices, functional furniture, high-speed business machines and then—in the name of economy—installs "cut-rate" lighting fixtures, efficiency goes straight down the drain.

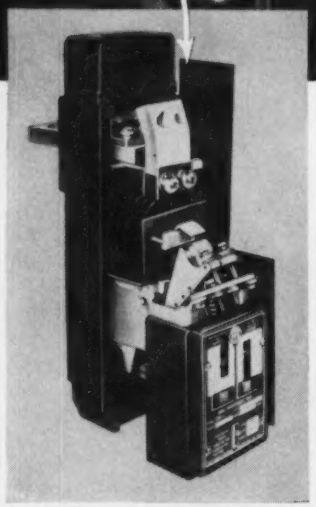
Before you buy any "just as good for less" fixture, compare it with Day-Brite. Look closely. Check design, assembly, features, output. Get the facts about installation and maintenance. You'll see the Day-Brite difference at once. Call your Day-Brite representative for a demonstration today. He's listed in the Yellow Pages. *Day-Brite Lighting, Inc., 5417 Bulwer Avenue, St. Louis 7, Missouri. Day-Brite Lighting, Inc., of California, 530 Martin Avenue, Santa Clara, Calif.*

NATION'S LARGEST MANUFACTURER
OF COMMERCIAL AND INDUSTRIAL
LIGHTING EQUIPMENT

With Day-Brite recessed troffers, employees get full efficiency from modern facilities. American Mutual Fire Insurance Co., Charleston, S. C.
71198

LOW VOLTAGE SWITCHGEAR





Here's SENSITIVE Circuit Protection

Some temporary overcurrents are tolerable; should even be permitted to occur. But sensitive circuit protection is needed to interrupt them when they persist too long or are of too high a magnitude.

The I-T-E Type OD-1 dual magnetic overcurrent trip device gives such protection. It permits temporary overcurrents, but limits them in duration and magnitude. This device will trip the circuit breaker after a predetermined interval on relatively low overcurrents or will trip instantaneously on high-magnitude fault currents. In either case you get safe, positive protection—sensitive to the needs of the circuit and the equipment on it.

For complete information on sensitive circuit protection, including selective tripping, undervoltage and other tripping devices, contact your local I-T-E sales representative. Or write for Bulletin 6004B. I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.

Features of the I-T-E Type OD-1 Trip Device

PRECISION BUILT and factory calibrated to provide the highest possible accuracy in operation.

SEALED SILICONE TIMING ELEMENT. No maintenance. No oil to handle, no level to maintain, no sludging.

QUIET. Resonant vibration dampeners prevent a-c noise and wear on parts.

COMPLETELY ADJUSTABLE IN SERVICE. The delay pickup is easily adjusted from 80 to 160% of the continuous current rating. The instantaneous pickup is adjustable from 500 to 1500% of the continuous current rating. The time delay is adjustable to any of three time delay bands—minimum, intermediate and maximum.

SAFE DEAD FRONT DESIGN. Insulated knobs permit safe adjustment on a *hot* circuit breaker.

DEPENDABLE impact tripping action. The *hammer blow* movement of the time delay armature at end of timing stroke gives positive operation.

FAST RESETTING. Sensitive check valve on the piston provides quick resetting of the time delay. Repeat tripping is assured.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

IN CANADA: EASTERN POWER DEVICES, LTD.

ANACONDA WIRE & CABLE COMPANY

INTER-OFFICE CORRESPONDENCE

COPIES TO:

C 460A

TO: Fred Luna

DATE July 1, 1957

FROM: W. E. Sprackling

OFFICE Hastings

SUBJECT: ADVERTISING

REFERRING TO: Quality Control
Inspection - ETL

FILE REFERENCE:

Fred, we've been telling our customers about our methods of Inspection, our Quality Control, and other manufacturing safeguards. But perhaps we're missing a bet. I think the BIG THING is what the Electrical Testing Laboratories, Inc. does for us -- not just the fact that they calibrate all of our testing equipment (that's quite common), but that they actually go through our test reports at all mills annually to see that our testing system is functioning the way management planned it.

I don't think any other outfit goes so far as to have such a complete independent audit. To me -- that's newsworthy -- our customers should know that we have an outside agency -- fully competent -- to watch after their interest.

Why not tell our story broadly -- after all, it's to the customers' interest -- they will appreciate, I'm sure, what is being done for them.

W. E. S.

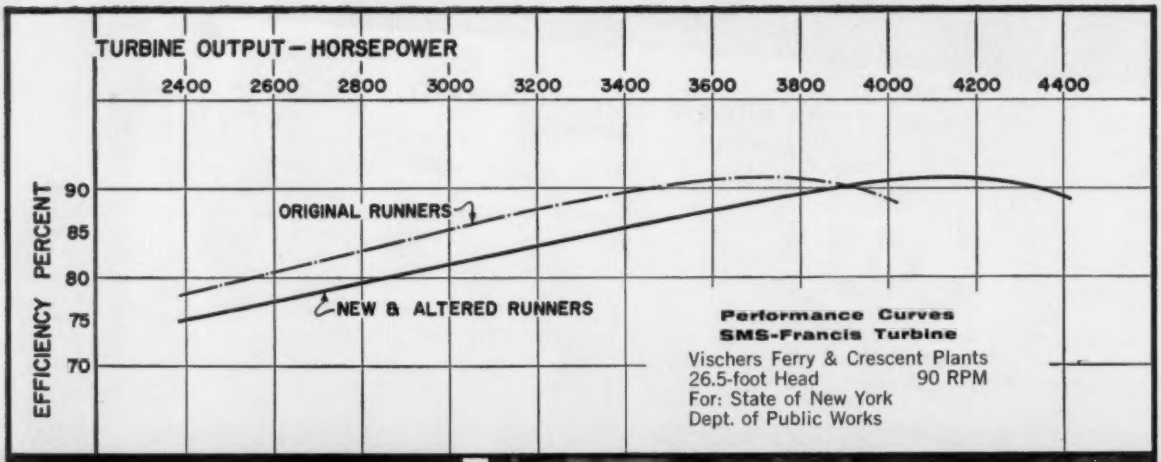
P. S. And another important thing -- the inspection department is entirely separate and independent of production -- reporting only to the Vice President in Charge of Manufacturing.

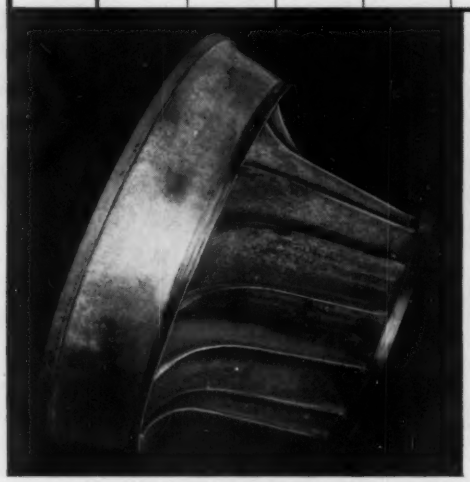
JEF - What more could we say? Sin for running this as is. What do you think? Fred

OK - JEF

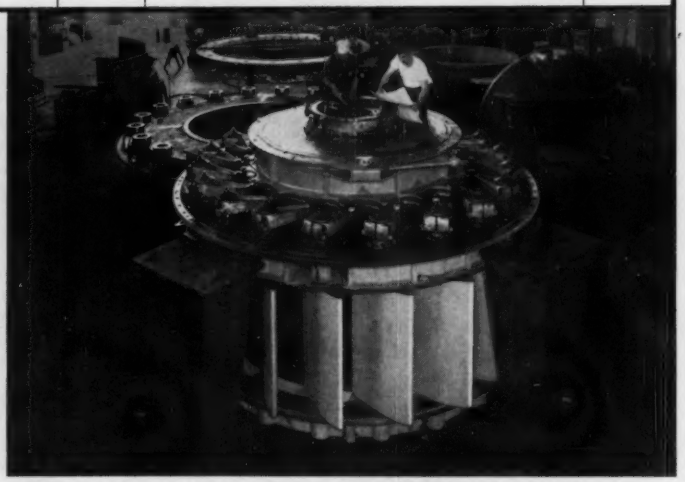
57422

LIVE BETTER ELECTRICALLY





Modifed runner for Vischers Ferry unit #4. Note excellent condition of runner after long initial service.



The rebuilt distributor of Crescent unit #1 is checked during final assembly in the SMS shops.

Rehabilitation of 34-Year-Old SMS Turbines **TO INCREASE POWER 10%**

Here's how hydro plants, operating on relatively low heads, can have rehabilitated turbines to get increased power and higher efficiencies. At the Vischers Ferry and Crescent Plants on the Mohawk River north of Albany, New York, four 86-inch SMS-Francis turbines have recently been rebuilt. Their increased capacity is shown in the curve above.

These SMS runners were in good mechanical condition after an average of 34 years of service. There was no evidence of weakness or failure, no erosion, and very little cavitation. Only minor modifications were needed on the bucket and throat to reshape them in accordance with modern designs and increase their output. SMS furnished a new runner to replace the first one removed, so that by rehabilitating one unit at a time and using the runner as a replacement for the next unit, outage time was kept to a minimum and the last runner has become a spare.

Modernization and rehabilitation of existing facilities can often be the answer to your need for more power at low cost. At SMS, you will find the most modern laboratory, engineering, and manufacturing facilities available. To obtain a general discussion of turbine rehabilitation given at a recent technical presentation, write on your letterhead to S. Morgan Smith Company, York, Pennsylvania.

More Power To . . .

S. MORGAN SMITH

HYDRODYNAMICS

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

Rotovalves • Ball Valves • R-S Butterfly Valves • Free-Discharge Valves • Liquid Heaters • Pumps • Hydraulic Turbines & Accessories

Mister, you're looking at a panelboard that's really built for Heavy Duty!

The heart of this QMB Saflex Distribution Panelboard is the quick-make, quick-break, horsepower rated switch unit.

It's loaded with features—

- Each switch unit individually enclosed in heavy gauge steel
- Dead front construction
- Heavy duty cast operating handle
- Double-spring mechanism insures positive opening under full load
- Visible blades for maximum safety
- Positive pressure fuse clips and switch jaws assure maintenance-free connections
- Cover interlock prevents unauthorized access but makes normal maintenance easier

QMB Saflex Distribution Panelboard

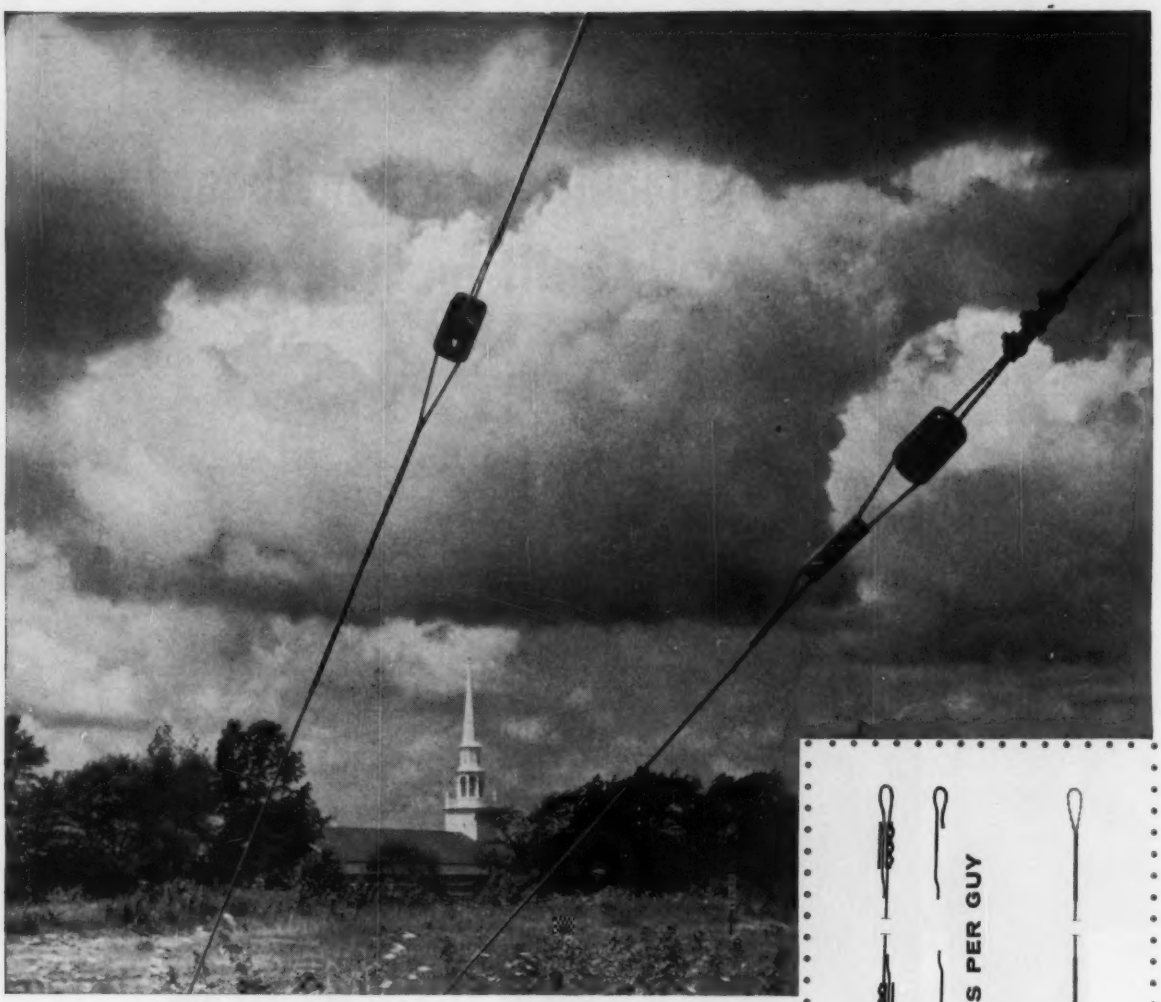
Here's a panelboard that's built for the tough jobs! But it goes a lot further than rugged construction. It's designed with plenty of space for easier wiring and maintenance.

Write for...

Bulletin S D-29 for further information
Address: Square D Company,
6060 Rivard Street,
Detroit 11, Michigan

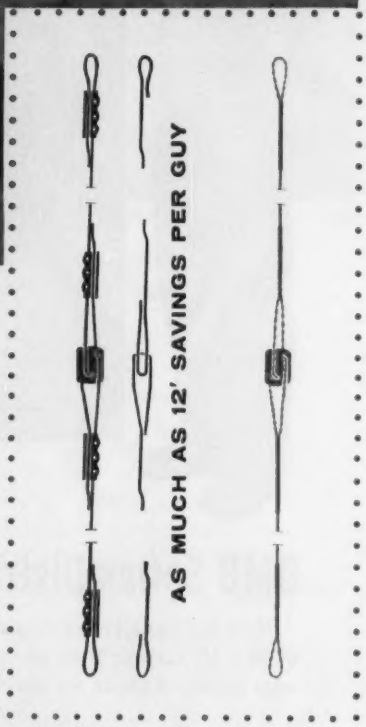
NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SQUARE D COMPANY



Up to 30% savings in strand... with PLP Guy-Grip Dead-Ends

You will find real guying economy with PLP Guy-Grip dead-ends. Because they eliminate strand looping, you can use *shorter, straight* lengths of guy strand. This means as much as 12 feet savings in strand per guy. What's more, the finished installation is neat, streamlined, efficient.



PX-60

Made in accordance with or for use under U. S. Patent No. 2,761,273; other patents issued and pending.

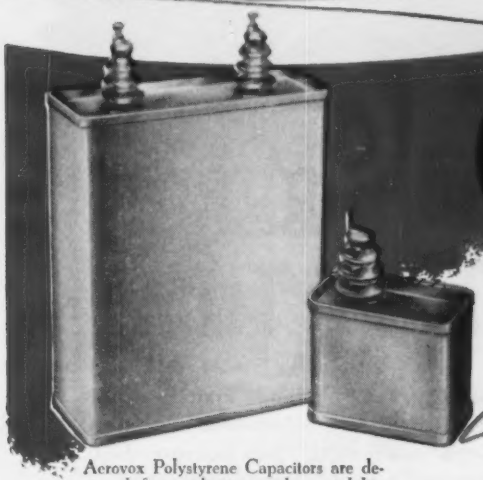
PREFORMED LINE PRODUCTS CO.

5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO
DEPT. NO. PR1B
Telephone: Cleveland EXpress 1-3571

For *HIGH* Insulation Resistance and Low Power Factor

AEROVOX Polystyrene Capacitors are wound with

NATVAR Styroflex®



Aerovox Polystyrene Capacitors are designed for applications where stability and low dielectric absorption are essential—such as computing devices, tuned circuits demanding highest Q standards, capacitance bridges, and laboratory standards. They are available in many case styles and in capacities from 0.001 mfd to 25. mfd. and in voltage ratings from 100 VDC to 1600 VDC.

AEROVOX Corporation, with ten plants from coast to coast, have been manufacturing capacitors since 1922. As leaders in the field, they have been quick to take advantage of new and better materials, and to anticipate the demands of the fastest growing industry—electronics.

They use Natvar Styroflex because it has all of the outstanding properties of polystyrene, plus complete flexibility, toughness and uniformity.

Natvar Styroflex is available in standard thicknesses from .0004" to .006" in rolls from ½" to approximately 10" in width. Ask for data sheet St-1.

Natvar

Natvar Products

- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
- Varnished—Silicone coated Fiberglas
- Varnished papers—rope and kraft
- Slot cell combinations, Aboglas®
- Isoglas® sheet, tape, tubing and sleeving
- Vinyl coated and varnished tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

Ask for Catalog No. 23

NATVAR CORPORATION

FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

TELEPHONE FULTON 8-8800 — CABLE ADDRESS NATVAR: RAHWAY, N. J.

221 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY

NOW

Another New and Bigger Forward Control 'Jeep' Truck

Here's the bigger, more powerful, 7,000-pound GVW Forward Control 'Jeep' FC-170 Truck:

- **Advanced Forward Control design!** The same new, advanced features that made the Forward Control 'Jeep' FC-150, an immediate success.
- **More cargo space on less wheelbase!** A 9-foot flatbed pickup box on a wheelbase only 103½-inches long! Bed is 27-inches from ground for back-saving ease of loading!
- **More efficient space utilization!** Compare it with any other 4-wheel drive truck — *only* the FC-170 gives you so much cargo space per inch of wheelbase!
- **All-time high for "big-load" maneuverability!** The FC-170 is the *only* 4-wheel drive truck to give you "go-anywhere" 'Jeep' maneuverability with a payload capacity of up to 3500-pounds.
- **Other outstanding features!** It's really a 4-wheel drive truck—*not* a modified 2-wheel drive truck, *not* a conversion! High-torque Hurricane 6-226 engine, time-tested and performance-proved • spacious Safety-View Cab • big wrap-around windshield • wide 63-inch tread for ground-gripping stability in off-road travel • shifts easily into 2-wheel drive for highway travel • with power take-off, operates a wide range of special equipment from winches to belt-driven machinery.

The newest addition to the 4-Wheel-Drive 'Jeep' family...ready for the bigger, tougher jobs!

SPACIOUS SAFETY-VIEW CAB puts you in a "Forward Control" position, gives you greater command of any driving situation.

EXTRA 4-WHEEL-DRIVE 'JEEP' TRACTION takes heavy loads to off-road areas impossible for ordinary vehicles to reach.

'Jeep' Forward Control
4-Wheel-Drive
FC-170

WILLYS... world's largest manufacturers of 4-Wheel-Drive Vehicles

Willys Motors, Inc., Toledo 1, Ohio

Why be half safe?

Specify AUTO-SPEED interruption . . . 3E Air Interrupter Switches

Howard Shatzer, 3E field engineer, checking an Air Interrupter Switch before shipment.

What is **Auto-speed interruption** . . . an automatically produced interruption that always occurs at the same point in the switching operation, and always takes the same time (one-half cycle). Human error is eliminated from the switching action by a trigger spring mechanism which trips the switch at a pre-set point. Contacts are separated inside a dry type interrupter unit.

Specify safety for personnel and equipment. No exposed Arc. 3E Air Interrupter Switches will not produce external arcing dangerous to men or equipment.

Specify economy Costing less than circuit breakers and with interrupting capacity not found in air break disconnects, 3E Air Interrupters are ideal for . . . interrupting magnetizing charging current of transformers . . . interrupting charging current of lines and busses . . . interrupting exciting current of feeder regulators . . . interrupting load currents to rated capacity . . . sectionalizing feeders and distribution circuits.

Specify Engineering Ability 3E's staff of engineers is experienced in adapting or combining equipment for complete switching centers or additions to existing units. Designing for unusual needs . . . corrosive or dusty atmospheres, unique space requirements, portable units, or carefully calculating tomorrow's expansion requirements . . . we are geared to handle the unusual.

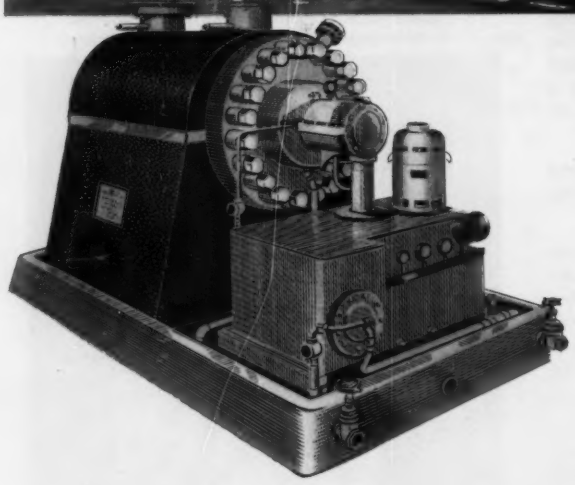
Howard Noble, 3E Sales Promotion Mgr., demonstrates Air Interrupters in a complete cubicle installation.

Write for Bulletin 152

3E Air Interrupter Switches are made in ratings up to 15 K.V.

ELECTRICAL ENGINEERS EQUIPMENT CO. Melrose Park, Illinois

Representatives in principal cities—in Canada by Power-Lite Devices, Ltd.



PACIFIC BOILER FEED PUMPS

CONTINUOUS POWER... a *must* in Southern California Edison's giant El Segundo steam station. Three Pacific boiler feed pumps were placed in operation for unit No. 1 in 1955. Two more Pacific pumps were selected and went on the line for unit No. 2 in 1956. The combined generating capacity of the two units is 350,000 kilowatts. These Pacifics, each delivering 685,000 lbs./hr. of 360°F. feed water at 2350 PSIG, unfailingly serve Southern California Edison's El Segundo plant needs. Whenever continuous boiler feed service is an absolute must... then nothing but the best, most dependable service will do... Pacific Boiler Feed Pumps!

Write for Bulletin 122

PACIFIC PUMPS INC.

HUNTINGTON PARK CALIFORNIA

Offices in all Principal Cities

ONE OF THE DRESSER INDUSTRIES

PACIFIC®

BF-26

these are the manufacturers who offer RLM-labeled units...

1,000 Words of Specifications

are back of every RLM-labeled industrial lighting unit!

The power of over 1,000 words of highest-in-history RLM lighting specifications is behind every RLM-labeled unit. Each word is in accord with basic, nationally-accepted, minimum standards for industrial lighting equipment efficiency, design and performance. RLM-labeled units conforming to these specifications are available from the leading manufacturers shown in the chart above. While each RLM Unit meets certain minimum RLM Standards, other special features, such as construction refinements or operating advancements, vary from unit to unit according to the ideas and skill of the individual manufacturer. For example, the RLM Label may be affixed to as many as 960 different types of RLM Dome Reflectors! Send for your complimentary copy of the 1957 RLM Specifications Book, containing a complete set of RLM Specifications.

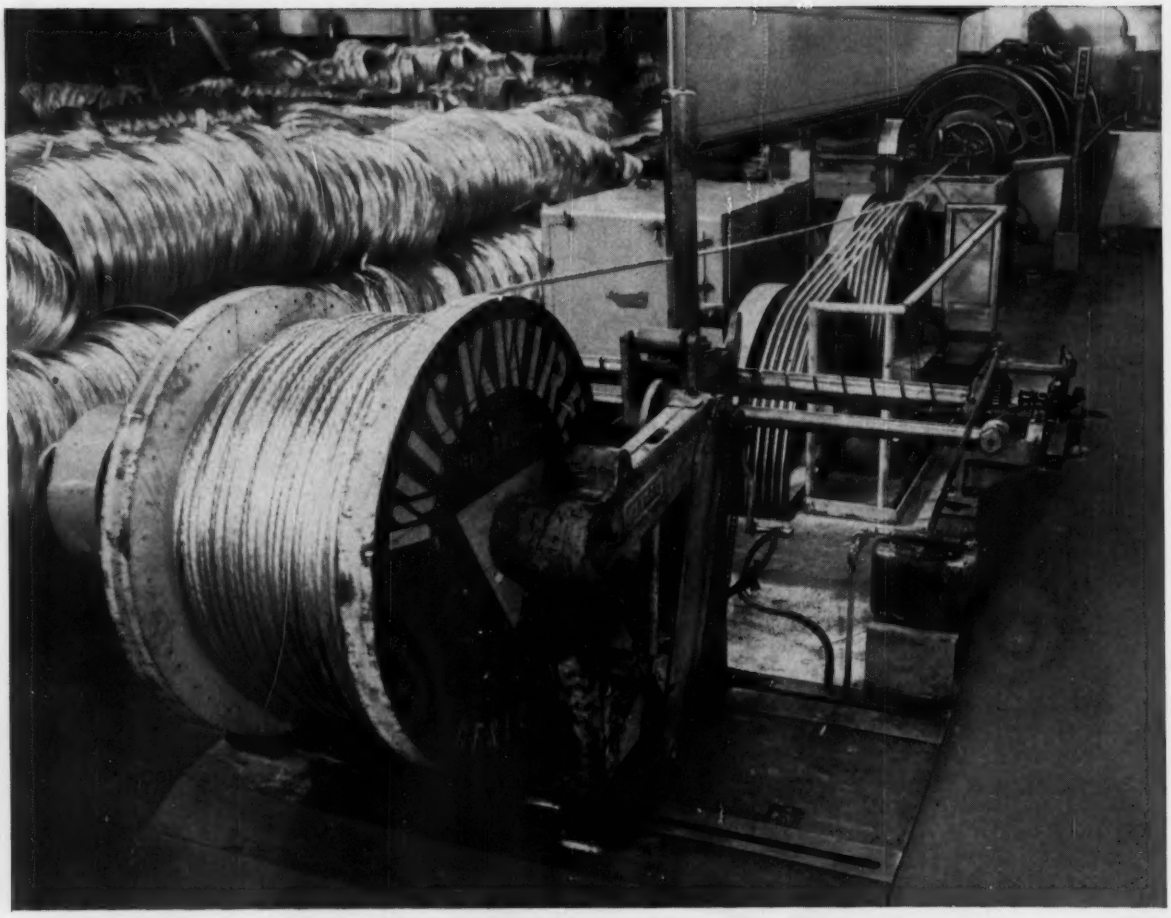
RLM STANDARDS INSTITUTE, Suite 821, 326 W. Madison St., Chicago 6, Ill.

Reg. U. S. Pat. Office

RLM STANDARDS INSTITUTE INCORPORATED

The letters RLM stand for Reflector and Lighting Equipment Manufacturers

R-1553



CF&I GALVANIZED STEEL STRAND

quality
service
dependability

CF&I Galvanized Steel Strand assures quality, service and dependability. This strand is manufactured to ASTM Specifications A-122, A-363 or to your own specification in seven- and three-wire constructions. Next time you need steel strand for ground, messenger or guy wire applications, contact the nearest CF&I sales office for complete details.

CF&I GALVANIZED STEEL STRAND
THE COLORADO FUEL AND IRON CORPORATION

WICKWIRE
CF&I PRODUCT

4613

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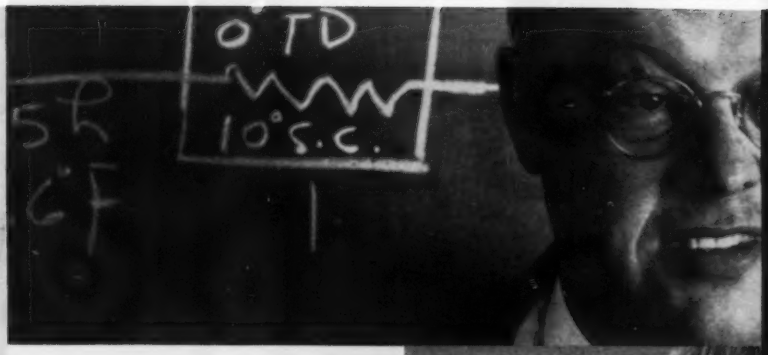
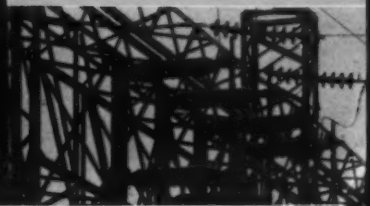


WHEN you consider expansion...
...the most important
investment you can make is in
the creative ability of men.

FLUOR

The Fluor Corporation, Ltd.
Engineers & Constructors
2500 S. Atlantic Blvd., Los Angeles



1945

THE FIRST . . . **FISHER-PIERCE PHOTOELECTRIC LIGHTING CONTROL**

. . . THE LATEST

1957

The year World War II ended, The Fisher-Pierce Company began work with utility engineers to develop photoelectric controls. Automatic, dependable switching of street lighting circuits when illumination was needed, regardless of time of day, season or weather, was the fundamental idea. The Series 61300 was the first of five different, major groups of F-P controls that have followed.

The experience has proved valuable to Fisher-Pierce and customers alike. Backed by an organization of more than 650 people, F-P today offers photoelectric lighting controls for all purposes . . . extensive sales and engineering services . . . research, development and production facilities to solve specific photoelectric/electronic equipment problems you may have. Your inquiry about F-P products, who uses them, and how you may use our development facilities for your own electronic equipment requirements, is welcomed.

THE FISHER-PIERCE CO., INC.

82 PEARL STREET, BOSTON 85, MASSACHUSETTS

POWERS American

SERIES LM-4

"Load-Master"

HYDRAULIC CRANE

Saves time and manpower because it speeds up loading and unloading jobs... handles work normally requiring several specially-equipped vehicles.

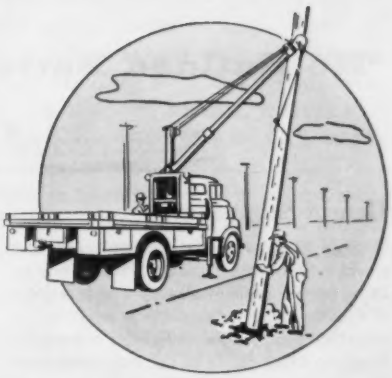
Load-Master lifts a 4000 lb. load with ease... moves it safely and quickly under the most adverse job conditions. Power is derived from a heavy-duty hydraulic-pump driven by the truck engine. Controls are located in a position which gives operator full view of the crane at all times.

Operator has absolute control of load at all times. The hydraulic system requires intentional movement of control levers before load position can be changed... and the load cannot drop if the truck engine stalls.

OPERATING FEATURES: Telescopic-type hydraulic boom can be spotted at any point from horizontal position to an 85° angle of elevation; hydraulically-powered mast will turn 360° in either direction; specially-designed winch, driven by a hydraulic motor, is grooved to wind cable evenly; hydraulic outriggers, with swivel-mounted foot plates, furnish extra side stability.

Load-Master is ideally suited for use with the Powers-American Series 300 Body shown above. It can also be furnished with bodies of other types... or shipped for mounting in your shop or local garage.

Price information and descriptive literature will be sent upon request.



Load-Master can be used for setting poles up to 45' in length. It requires only 20" of mounting space behind the truck cab. Boom extensions to 22' can be furnished.

McCABE-POWERS AUTO BODY COMPANY

5900 NO. BROADWAY
ST. LOUIS 15, MO.

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"He Builded Better Than He Knew"*

*Ralph Waldo Emerson's "The Problem"

George Stephenson:

George Stephenson's contract for the world's first public railroad was won, in 1829, on the basis of quality and integrity of craftsmanship. Stephenson went on to establish nine major railroads, before his death in 1848. Some of the standards laid down by him, over one hundred years ago, are still in use today.

When Austin Goodyear Day developed Kerite, he too "Builded Better Than He Knew." Early telegraph and railroad signal installations proved that Kerite was completely reliable. Throughout the years, the inherent qualities of Kerite insulation have protected the increasingly heavy voltages of utility power and industrial lines. Pioneers, and all who serve the public, know that time is the measure of a product's value. The proven long-life service of Kerite cable continues as today's standard for major installations around the world.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

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Founded 1854

EDITORIALS

Fast Writeoffs – Shotgun or Boomerang

Professional federal power advocates used the fast tax writeoff issue with telling effect to blast the Hells Canyon bill through the Senate (EW, July 1, pp. 40 and 47). They used it as a shotgun to scatter confusion among Congress and the public. But this weapon could just as easily become a boomerang inflicting considerable damage on those who have used it most effectively.

The supreme irony of the hassle over fast tax writeoffs is that it is an issue over tax deferral raised by the very people who favor completely tax-free electric utility operations—at least as far as federal taxes are concerned.

Main reason that the writeoff issue proved effective this year is that the tax deferral procedure hit a sensitive public nerve in this year of a record peacetime federal budget and continued pressure from high taxes.

Merely by deferring a small part of their total tax bill for a relatively short period, it was calculated that electric companies would stand to benefit by as much as $4.7 billion over the next thirty-odd years. For a single development, the tax deferral was said to cost the government as much as $83 million. Now remember that these benefits or these costs are arrived at by compounding temporary tax savings on what is a very small part of the electric utility company plant.

These are some interesting calculations. But suppose that instead of temporary tax deferrals, there was total escape from federal income taxes. Then, how much would the companies benefit? How much would the government suffer? This is, of course, the situation with the federal and other government power operations.

When the public digs down under the confusion spread by the professional federal power advocates and finds that the fuss is stirred up by those who enjoy freedom from federal taxation in their operations, there will be more questions raised.

These advocates may very well find that their shotgun is, in reality, a boomerang.

Outdoor Lighting and a Utility's Birthright

On page 87 begins a special report on residential, commercial, and industrial outdoor lighting in the U. S. today.

Outdoor lighting—for that matter, all lighting—has been undergoing a revolution since the end of World War II. The causes are manifold: radical changes in the living and shopping habits of Americans; the development of new, more-efficient light sources; the constant scramble for more business in a burgeoning economy. These have all played their part.

Some areas in the lighting business even seem to be having a rebirth. Floodlighting of office buildings is an outstanding example.

All this bodes well for the power companies. It has meant and can continue to mean the sale of more and more kilowatt-hours. But as the report indicates, utilities do not seem to be getting as much from the lighting market as they might. There is still a tendency to regard lighting with indifference. The attitude is: "We're going to get the lighting load anyway; so why promote it? Besides, it takes too much effort to sell kilowatt-hours in such small amounts."

This blind spot is especially evident today with regard to residential lighting. It is reflected too in the lack of appreciation for the potential lighting market.

The need for lighting brought the electric power business into being. The opportunities it presents are the industry's birthright. Today outdoor lighting is a very real part of that birthright. But it has to be developed. And development means more knowledge of the market and its potential, and aggressive, specialized promotional efforts directed to all parts of that market.

SAMUEL CAMPBELL MOORE PLANT will generate 190,000 kw; New England Electric System now has 23 hydro plants

NEES and IP&L Dedicate Plants

Indianapolis utility marks completion of 376-Mw H. T. Pritchard station; New England Electric System dedicates 190-Mw S. C. Moore plant on Connecticut River

Tax and social benefits derived from private construction of electric power plants were stressed at the dedications of Indianapolis Power & Light Co's H. T. Pritchard station and New England Electric System's Samuel Campbell Moore hydroelectric power station.

Now completed with six units, the $51-million Indiana plant has a total capacity of 376,000 kw. Construction began in 1947 and the first machine, a 45,000-kw unit, was put in service in February, 1949. Located on White River southwest of Indianapolis, the station has direct railroad access to Indiana coal and use of the White River waters. It was formerly known as the White River plant before the June 19, 1957, dedication ceremonies.

Pritchard, whose name the plant bears, is a retired president of the company and is present chairman of the board of IP&L. He rose from a dynamo tender to his present status.

In his opening remarks, O. T. Fitzwater, president of IP&L, pointed out that the station, in addition to its value as a power source, has benefited Morgan county by becoming its largest tax source. This helps to improve schools, roads and other public services, he said. The plant also has created a new payroll of about $750,000 a year in Morgan county. All of this, he pointed out, is the result of local business planning by Indiana citizens and the invested savings of many men and women—not from government planning or financing.

Principal speaker on the program was Edwin Vennard, vice president and managing director of Edison Electric Institute, who warned of government control and ownership of industry. He remarked, "Mod-

WILLIAM WEBSTER unveiled plaque at dedication of Moore hydro station

PRITCHARD PLANT honors IP&L's board chairman—who once tended dynamos

ern history teaches us that there is one common characteristic of all those systems under which man is not free. That characteristic is this:. Government operates the machinery of production. In all cases government operates the power business as part of the machinery of production.

"I say it is an issue today because we are facing here in America not so much the encroachment of communism or socialism but a tendency on the part of some people to call upon their government to do for them those things which men in America traditionally have done for themselves. We find a manifestation of that in government encroachment in the power business. It has made some progress in the past 20 years despite the fact that the majority of the American people do not want that in America."

Moore Plant Dedicated

Dedication of the 190,000-kw Samuel Campbell Moore station on the Connecticut River near Littleton, N. H., was a crowning event in New England Electric System's golden anniversary. The ceremonies for the $41-million plant were held June 20.

NEES now has 23 hydro plants besides 12 steam plants, pointed out president Irwin L. Moore, son of the late S. C. Moore. Now the system has a capacity of 1,250,000 kw to serve 750,000 customers.

Moore said, "The comprehensive development of these river resources is a source of pride in the fact that all the system's plants were built by private capital, the money of private investors, and not a single dollar of all the millions that have been poured into these plants has come out of the pockets of the American taxpayer. Indeed, far from putting a drain on the taxpayer, these plants have added taxable property to hundreds of communities, and produce taxable earnings to help support local, state, and federal government functions.

The dedicatory plaque was unveiled by William Webster, executive vice president of NEES and president of Yankee Atomic Electric Co. Moore also reviewed NEES plans for participation in atomic power programs with Yankee Atomic Electric Co.

SALESMEN, fooled by this classy appearance, sometimes knock on Manito's door

WWP 'Simplifies' Its Subs

Washington Water Power's "residential-type" substations are trending toward simplicity with little or no effect on acceptance, the company reports.

Such substations run the gamut from the classy brick-and-stucco house pictured above to the roofless, masonry-block structure below.

The 2,000-kva Manito substation in Spokane so much resembles a house that it occasionally fools salesmen and new neighborhood residents. It is flanked by a luxurious duplex and an attractive single-family residence. It is set on a well-manicured lawn landscaped with flowering shrubs.

Manito is a full-fledged substation with transformers in its open-roof garage. Wires run underground. Shortly after its completion, WWP had a noise problem, but solved it effectively by setting transformers on cork bases.

A typical "simplified" unit is the 9,000-kva Lidgerwood regulator sub which has an open roof and overhead wires from lines running through the center of a residential block. Measuring 34 x 34 x 15, the station has double doors on the back and no continuous floor. Equipment is set on concrete, the rest being gravel for drainage. It is flanked by a duplex and a house.

WWP crews care for these residential-type stations by mowing their lawns, trimming shrubbery, and—in winter—shoveling snow.

LIDGERWOOD REGULATOR unit, not so dressy, seems to win local acceptance, too

Battle Over Civilian Reactor Program Flares

Democrats launch all-out push for AEC ownership of two large scale reactors, co-op facilities; strategy entangles AEC appointees, indemnity insurance

Democrats and Republicans are now skirmishing seriously over the nation's civilian atomic power program. The showdown began last week when the Joint Committee on Atomic Energy tried to draft a bill authorizing the Atomic Energy Commission's expenditures in 1958 for civilian power reactors.

Time and events have changed some elements, but the basic issue remains the same: Democrats hope to force the Administration to undertake construction of power reactors: Administration forces will resist these efforts to the bitter end.

Compromise Remote

So hectic were the sessions that further deliberations were put off another week to allow the dust to settle. At week's end there appeared no grounds for compromise.

What has happened is this:

Democratic strategy has finally forced AEC into a position where, through the new amendment to the 1954 Atomic Energy Act, it must obtain Congressional clearance for every reactor project it undertakes, either alone or in partnership.

Without such endorsement, AEC will not obtain approval of appropriations from the House Appropriations Committee headed by Rep Clarence Cannon (D-Mo.), a foe of the Administration's present AEC-industry partnership arrangements.

In line with this new law, JCAE held hearings in June on all the civilian power reactor projects. The hearings were intended to permit JCAE to draft authorizing legislation for AEC's appropriations.

The authorizing bill will have to be passed by both houses and signed by the President before AEC can ask for the needed funds.

As of last week, JCAE could not agree on the terms of the authorizing bill and the appropriations committee was waiting for this bill before giving AEC the money.

The authorization approval sought by AEC includes these projects:

Power Reactor Development Co ($4.2 million); Consumers Public Power District ($44.2 million); Elk River Rural Co-op Power Assn ($8.4 million); Wolverine Electric Co-op ($4.9 million); City of Piqua, Ohio ($7.5 million); and Chugach Electric Assn ($13.6 million). In addition AEC seeks $30 million for projects it hopes to approve under its third round invitation to industry and $11 million in post-construction research and development.

The Democrats are now attempting to include in any authorization bill the stipulation that AEC construct certain full-scale power reactors on its own, and that it assume greater responsibility for all the second round projects (the co-op and public power projects). Furthermore, the Democrats are trying to kill the PRDC project which they have opposed ever since AEC issued a construction permit to PRDC last August.

For the co-op projects, Democrats want AEC to own the reactor portion and sell the steam to the co-op at a price no higher than it would pay for steam from a conventional coal-fired plant.

Proposal Differs

This proposal would differ from the present plan only in that AEC would own the reactor. Actually AEC intends to finance the full reactor construction cost anyway.

The Democratic objective is to forestall any possibility the Administration will claim a precedent in putting up most of the money for co-op projects and try to advance more money for industry projects.

In regard to large-scale reactors, the Democrats argue that AEC was denied permission by the Budget Bureau to build two large-scale reactors on its own, at $150 to $160 million. These would have been a natural uranium, gas-cooled reactor and an aqueous homogeneous unit.

The Democrats want to authorize AEC to spend this money on two large reactors which AEC will build and own. There is still some haggling on the types, however.

It is pretty certain one will be the natural uranium gas-cooled (or Calder Hall) reactor.

There is less agreement on the second. JCAE Chairman Carl Durham raises these points: Plutonium producing reactors have been operating at Hanford for 15 years. They are expensive to operate and probably could be rebuilt more efficiently. If rebuilt, he asks, should they be single purpose plutonium producers or dual-purpose power and plutonium producers?

Plutonium Surplus Possible

Durham is also concerned about consequences of the disarmament talks. Should they succeed, he says, the U. S. will be stuck with large stockpiles of plutonium.

With this in mind, the Democrats suggest AEC build a plutonium recycling reactor.

Democrats estimate their suggested program would cost no more than the $150-$160 million AEC had asked the Budget Bureau to authorize.

Finally, the Democrats plan to cut at least $1 million from the $4.2 million AEC wants for PRDC.

The situation is delicate for the Administration. The Senate has not yet passed the indemnity insurance bill. Action may be held up there until the authorization bill is settled. If the Democrats lose points on authorization they can retaliate against the insurance bill.

Another Democrat bargaining point will be to hold up confirmation of John Floberg and John Graham, the two Eisenhower nominees for AEC vacancies. Success of this move is questionable since Graham is a Democrat and has Democratic support.

There is little doubt the tangle will have to be resolved by compromise. Inevitably it will mean AEC will build some reactors.

Debt Is Repaid in Israel

Few debts are repaid in the measure chosen by Harry F. Fischbach (at left in the ceremonies shown here). The tanned 66-yr-old board chairman of the electrical construction firm Fischbach & Moore, Inc, has contributed and pledged over $400,000 for facilities at Technion —Israel Institute of Technology, Inc.

It Started 50 Years Ago

The gifts are motivated by events of more than half a century ago. As a hungry youngster in Rumania, Fischbach went to primary school for two years in Bucharest and, later, two more years in Vienna. During both intervals, support from the Jewish communities of the two cities spelled the difference between an education and hot meals or meager subsistence for him and his widowed mother.

To repay this generosity Fischbach has given freely of time and energy in addition to funds for Technion. The "M.I.T. of the Middle East" is located on its new campus site on historic Mt. Carmel on the outskirts of Haifa. In the picture above, Mr and Mrs Fischbach have formally opened the new Harry F. Fischbach Electrical Engineering Building. Prime Minister David Ben Gurion and Gen Yaacov Dori, Technion president, assisted.

The engineering building was made possible through gifts from the U. S. electrical industry. Fischbach donated $250,000 to the construction fund and, as vice president of Technion, solicited $500,000 more.

To Accommodate 800

Some 800 students will be accommodated in the structure. It will be a far cry from the cramped quarters on the old campus in Haifa —where chairs were omitted in the classrooms so more students could crowd in to hear lectures.

"Technion," says Fischbach, "is the most important single factor in the future of Israel since the whole development is dependent on it for research and development."

Has "Home" Interests, Too

His interest in technical education is evident in the U. S. also. Contributions have aided schools such as Brandeis University, Albert Einstein School of Medicine, and Rensselaer Polytechnic Institute.

A big (6 ft, 200 lb), dynamic man, Fischbach disclaims any credit for the impressive sums he's solicited from industry leaders. "It's just that I know a lot of them." His firm, the largest of its kind in the U. S., is well acquainted with electric utility construction, having handled power plant wiring from coast to coast. The company has work under way now for Mississippi Power Co, Georgia Power Co, Pacific Gas & Electric Co, and Southwestern Public Service Co.

'Act, Don't Advise'...

. . . is new policy plan for multi-purpose projects in Northwest by new group

The proposed Columbia Interstate Compact Commission may switch from a recommending to an "action agency."

At a recent meeting the commission voted 6 to 2 in favor of studying the possibility of creating, under compact provisions, an action agency "which would be empowered to acquire, finance, construct, operate, and administer multi-purpose projects" in the Columbia Basin.

The proposed change would be a decided departure from the commission's thinking since its origin in 1950, thinking which consistently favored the drafting of a strictly recommendatory compact.

Reflects Political Shift

The new direction partly reflects changes in CIC appointees resulting from the change from Republican to Democratic administrations in Oregon and Washington.

Proposed by Oregon State Sen Alfred H. Corbett, the resolution fell as a block buster in its original form—which called for establishing an action agency instead of making a study of the possibility of such an agency.

Corbett said the Oregon and Washington delegations had agreed before the meeting that the compact needs greater authority and a means of carrying through its recommendations for multi-purpose projects.

The compact and proposed federal consent legislation must be approved by legislatures of four states —Oregon, Washington, Idaho, and Montana—and by Congress before it becomes effective.

The action agency plan was opposed by Idaho and Wyoming. Members of the Oregon and Washington delegations predicted tough resistance from some of the upper basin states. But they indicated that without drastic revision there was slight chance of compact legislation passing either of their legislatures.

The previous draft, submitted this year to Washington and Oregon legislatures, was refused by both. It called for recommendations only.

ETRC to Reveal Vital "Family Secrets"

Small reactor to show how its big brother will work at full power. Other items: "Atom" papers at AIEE; new nuclear system for foreign market; new shielding

Atomic news this week embraced panoramic activity: The value of a test reactor at Atomic Energy Commission's National Reactor Testing Station, "atomic" papers to be presented at American Institute of Electrical Engineering's Pacific general meeting, a nuclear system especially aimed at the foreign market, groundbreaking at two new projects, and a refinement in shielding.

• An Engineering Test Reactor Critical Facility (ETRC) at AEC's Idaho Falls, Idaho, reactor testing station is expected to pay for itself in a year by enabling scientists to operate its big brother—the Engineering Test Reactor (ETR)—at full power safely and without interruption, reports Phillips Petroleum Co, builders and operators of ETRC.

Using the smaller ETRC as a guinea pig, scientists now are running experiments aimed at predicting how big ETR will act under given conditions. Successful accomplishment of this objective means a saving in time by obviating measurements of ETR's operating characteristics when the latter goes to work later this year.

ETR is designed to produce an exceptionally intense stream of neutrons. It will be used to reveal how atomic fuel elements and reactor parts stand up under neutron bombardment.

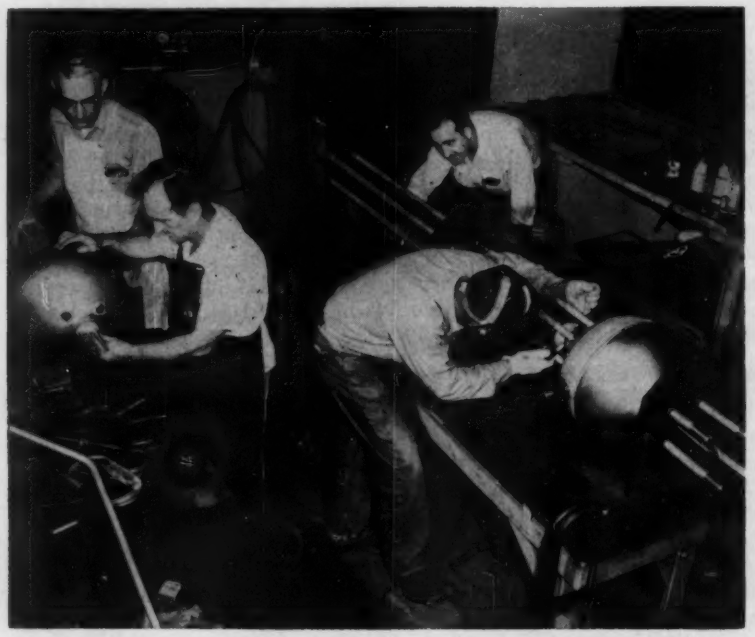
• Utilities with present or future interests in nuclear power plants may find some guidance in at least four technical papers to be presented on atomic energy at the Aug. 28-30 Pacific general meeting of AIEE. They are: "Some Operational Problems of the Nuclear Power Plant," "Training Operating Personnel for Nuclear Power Plants," "A Method of Evaluating Reactor Hazards," and "Safety in Nuclear Power Plants."

• A design for a nuclear steam generating system that should meet the needs of foreign nations has been announced by Babcock & Wilcox Co. Of the "pressurized water" type, the reactor design is suitable for a plant of about 133-Mw capacity, B&W said. Using slightly enriched uranium fuel, the plant would generate nearly 2 million pounds of steam an hour—more if a steam superheater were added.

• Colorful flourishes characterized the beginnings of two new atom projects recently. Using a shovel having as the bigger part of its handle a 2-ft-long nuclear fuel element shape, dignitaries turned the first spadeful of earth for Sylvania-Corning Nuclear Corp's new Hicksville, N. Y., plant, which eventually will make fuel elements.

Westinghouse Electric Corp was even fancier in ceremonies starting work on "the world's first industry-owned nuclear materials testing reactor at Waltz Mill, Pa. Groundbreaking was started by remote control 20 miles from the site. The new reactor will operate at about 20 Mw when completed.

• California Ink Co has started production of a new radiation shielding at its Berkeley plant. Made of granulated lead in a paraffin wax base, the shielding can be molded into any size or shape, the company reports.



Germany to Get 2 Research Reactors

Two nuclear research reactors are now earmarked for West Germany for training purposes, nuclear physics studies, research, and production of industrial and commercial radioisotopes. One is to be situated at Johann Wolfgang Goethe University in Frankfurt. The other, to be at the Institute of Nuclear Research in West Berlin, is to be used by Free University and the University of Technology. Employees of Atomics International, a division of North American Aviation, Inc., are shown here fabricating cores for both reactors.

Can You Trim Bond Rate Impact?

Here are three suggestions for consideration:

- **Use bank loans secured by issuance of mortgage bonds**
- **Sell common stock, now at attractive price levels**
- **Use non-callable clauses in mortgage bond marketing**

In view of the present record high level of interest rates on new issues of bonds of electric companies, it would seem wise for management to give serious consideration to this question: Is it advisable to minimize or avoid the impact of these higher rates by raising funds from other sources? That is:

Use Bank Loans

1. Bank loans could, if desired, be secured by issuance of the bonds which would otherwise be issued. Where loans are limited to the bonds so issued or issuable, the risk becomes one of a wager on money rates since the loan can always be paid by selling the bonds.

Sell Common Stock

2. Sale of common stock, or adding to a prospective common stock issue, could be used to raise a portion of the funds which would be otherwise obtained by the sale of bonds. While the going rates for bond interest and preferred stock dividends are at record high levels, dividend yields and price-earnings ratios on common stock of electric utility issues are still at levels attractive to the issuer.

Assume a differential of about 5% after taxes as between an estimated 7.6% cost of common stock funds and a 5.2% cost of money (to a utility with an "A" rated bond). Less taxes, this would be about 2.6%. Loss would be avoided if the rate for such bonds declined to 4.2% at or before three years, or to 3.2% at or before the end of six years.

Furthermore this "loss" is not in the form of paying out money to creditors or other "outsiders" but merely tends to dilute the earnings applicable to the common stock.

If, within 18 months after sale of such additional stock the bond rate dropped to 4.2% on such bonds, the net after-tax saving to the company over their life would be twice the decrease in earnings during the 18 months period applicable to the common stock.

Use Non-Callable Clauses

Consideration is now being given by electric utilities to eliminating redemption rights for five years to reduce the interest cost of new funded debt issues.

Assuming such reduced interest were .20% per annum (.10% per annum after federal income taxes), this saving over the life of the new bonds (about 25 years giving effect to an annual 1% sinking fund on a 30-year issue) would be more than offset if interest rates dropped to 3.2% for "A" bonds (the level within the past two years) within 18 months after the new bonds were issued at an 5.2% assumed rate.

If the drop in this period were to only 4.2%, more than half the saving from the reduced interest rate due to eliminating redemption would still be realized.

This assumes the saving in the lower future rates applies for a maximum of 3½ years from the 18 month period to the end of the five-year period when redemption is prohibited. Actually however, inability to redeem within the five-year period might prohibit economic redemption for many more than the five years and could extend for the entire 30-year life of the bonds.

If, for example, the period were ten years, then net after-tax savings to the company would be 50% higher than the original saving (assuming a 4.2% rate for the redemption) and 250% more than such saving if the rate were 3.2%.

If such inability to refund extended 15 years after the first opportunity (18 months after the original sale of the bonds) then savings would exceed the savings from inserting the redemption prohibition by 100% with the reduced rate at 4.2% and by 420% at 3.2% rate.

Finally, if the first opportunity were lost for the entire remaining life of the bonds, the savings from retaining the redemption right would amount to 250% of the original savings from the five-year prohibition, with a 4.2% rate at the end of 18 months, and as high as 700% of the last mentioned saving, if a 3.2% rate is assumed at that point.

Possible curves of fluctuations in interest rates over the life of a 30-year bond are infinite. But assuming one of the myriad possible combinations of rate movements over such period, namely:

1. Reduction in rate three years from now to 3.95% on an "A" rated bond today issuable at 5.2%;

2. A following rise in rate to above 5% (making redemption uneconomic) continuing at this level for ten years;

3. Followed by a drop in rate at that time to 4.45%, 15 years from now.

The result would be that if redemption were now prohibited for the first five years, such redemption would be deferred until 15 years from the present and would then be made on a 4.45% basis. Without the prohibition it would have occurred three years from now on a 3.95% basis.

Saving From Redemption Right

Thus the saving from retaining the redemption right (assuming redemption premium represents the equivalent of .20% per annum in rate) would be the difference between 4.95% and 3.95% or 1% before and .50% after income taxes.

For ten years this would amount to 5% of the issue to which would be added a further saving of .50% before and .25% after taxes for the remaining life of about 12 years (following the redemption 15 years hence). This makes an additional saving of 3% of the issue, or a total of 8% thereof as compared with an assumed savings on the original issue made at the present time of 2.5% of the issue over its life by reason of lower interest derived from prohibiting the redemption for five years.

Strike in Florida

The first work stoppage in Florida Power & Light Co's history came July 5 when a five-day wildcat strike pulled 1,200 construction and maintenance workers off their jobs in Dade and Broward Counties. The International Brotherhood of Electrical Workers—their union—termed the strike "unauthorized" and "illegal."

Cause of the strike was an incident that occurred three weeks earlier. FP&L's Fort Lauderdale plant superintendent asked a union official at his plant to "go home for the remainder of the day" following a disagreement. The striking workers demanded that the superintendent be dismissed by the utility.

Although the strike was unauthorized by IBEW, local union officials from Miami and Ft. Lauderdale met with FP&L's Chairman McGregor Smith, and other company officials. An agreement was reached. But, according to FP&L's Vice President M. B. McDonald, the only result of the meetings was that the workers went back on the job with the company's promise of no disciplinary action. Neither the superintendent nor the union official was dismissed.

The walkout greatly delayed emergency repairs and halted construction.

Lighting Experts Fight Fog

Through control of lighting, it is possible to increase visibility on fog-cloaked highways by 100% or more, reports Charles R. Marsh, associate professor of electrical engineering at Pennsylvania State University. Through tests, he demonstrated recently that visibility is improved if light is directed perpendicularly to the driver's line of sight.

This can be done if overhead roadway lights are installed which cast narrow beams straight down to the pavement (meaning more lamps per mile for the same degree of lighting), or if reflector floods are put on the road's shoulder slightly above the pavement level, or if auto headlights are dropped below bumper level and—for maximum effect—are polarized. The latter technique does not produce light at right angles to the driver's line of sight, but improves his visibility by approaching that condition.

A $750,000 Verdict

The largest verdict believed ever rendered for personal injuries to an individual in the U. S. has been handed down as a $750,000 judgment against Commonwealth Edison Co and Northern Illinois Gas Co. A 9-year-old boy lost parts of both legs and suffered permanent brain damage among other serious injuries when Commonwealth Ed drilled into a gas line in front of a hardware store while replacing a light pole in Roselle, Ill. An explosion followed about 40 min later, killing seven persons. Commonwealth Ed was charged with negligence in failing to locate the gas line properly; the gas company was charged similarly for not repairing the leak promptly after it was reported. Commonwealth Ed said it intends to appeal the judgment.

GOP Strategem in Oregon

Oregon's Republican party should adopt an "impartial attitude" toward public-*vs.*-private power issues. This was advocated by Republican State Chairman James F. Short at a recent meeting of the Oregon GOP central committee.

"We are going to have to become less closely aligned with private power in the future," Short said. Later he elaborated: "We should work to make power available on an equitable basis that will keep us in competition with other states, but . . . how this is done should not be a party matter."

Welcome News

Kansas City Power & Light Co says it won't bill customers whose houses or business establishments were destroyed by the May 20 tornado. It is estimated that 400 to 500 customers thus will not be asked to pay for electricity consumed between May 6, date of the last reading, and May 20. When fire burns a customer's property, KCP&L ordinarily sends a prorated bill based on previous consumption.

But All Ended Well

In West Virginia, a Bluefield district customer of Appalachian Electric Power Co—upon receiving his first bill on a business-machine punched card—endorsed and cashed it at a local store. He thought AEP was sending him a refund.

Agreement Reached

The Chelan County Public Utility District of Wenatchee, Wash., has reached an agreement with Aluminum Co of America under which the PUD will sell 23% of the power from its Rocky Reach hydroelectric project to Alcoa for its nearby reduction plant. The aluminum company, in return, will pay 23% of all costs of building and operating the project over a 50-year period. Alcoa announced that the resultant firming up of its Wenatchee power requirements will be accompanied by a $10-million expansion of its local reduction plant by mid-1961.

Use 'Rouse-Power' To Win Over Your Utility Customers

Make it easy for employees to help improve customer relations. You must win confidence and then win the active support of public

RALPH C. SWARTZ, Vice President, Commercial, Pennsylvania Power & Light Co, Allentown, Pa.

If, as an individual, you were going to make a serious effort to win friends and influence people, you might begin by taking a Dale Carnegie or similar course. You would soon learn that going around and telling people how good you are is not the way to succeed. You start with yourself and improve a host of things that can be summarized as appearance and manners.

A corporation must do the same things and, therefore—to be successful—a corporate program must be about nine-tenths doing and one-tenth talking. It is something that you, and all of you, must do for yourselves. You cannot hire it to be done.

Utilities should not turn their backs on publicity and public information media. But a utility must first win the confidence of its customers—who are its public.

Public confidence can't be built on make-believe. The foundation of confidence is sincerity. We can earn that confidence only by doing all we can possibly afford to do to secure good customer relations.

In this area, the appearance and attitude of salesmen, engineers, cashiers, etc, who deal with customers must be considered. Such personnel cannot be chosen solely on the basis of technical competence. Obviously, in many situations the relations man and the technical man will be unable to agree on a selection.

The selection, direction and training of personnel, development of practices, formulation of policy, etc, should all be designed with the customer in mind. And in this designing, it must be realized that only the customer can know what the customer thinks.

Opinion Survey Comes First

Therefore, one of the first things to be done is to find out what the customer thinks. This can be done through opinion surveys, analysis of complaints received, investigation of customer satisfaction with service calls, etc. By these means there can be obtained positive indications of practices which may need revision.

These studies will also reveal employee attitudes which need improvement and areas in which employee training is required. A proper use of the results will assist in improving these attitudes and formulating the training.

Because employees generally get from customers more gripes than compliments, their perspective may become distorted. Surveys can help correct this because most produce enough favorable replies to show employees that they and their company are fairly well thought of. And this, if properly presented, can make employees eager to help improve customer opinion of their company.

But it is not enough for employees to want to help. Everything that can be done to make it easier for them to help should be done.

The steps by which this can be done can, perhaps, be classified as: **1.** Organization, **2.** Explanation, **3.** Cooperation, and **4.** Stimulation.

The way to carry out these steps must be determined by each company for itself. But an essential for "Stimulation" is an adequate and continuous demonstration of how important the company considers customer contact employees to be.

And the customer contact employees are very important employees. For, if the activities of these employees do not result in satisfied customers, then the careful planning and hard work that went into the design, construction, and efficient operation of facilities; financial structures; etc, will not achieve complete success.

But, we must realize that when customer relations programs achieve success, we may have won friends —but we have not necessarily influenced people. We may have convinced our customers that we are solid citizens, but we will not have persuaded many of them to help

us actively where we need their help.

At a very minimum, however, we will probably have achieved the first requirement for successful communication. We will have a receptive audience.

Message Must Be Clear

The second requirement is an understandable message. But if the purpose of communication is persuasion, it must be more than that. The message must not only be understandable, it must have "rousepower."

To persuade an audience you must present a very simple and clear-cut issue and make it easy for them to choose a side—your side.

Because the difficulties in which we are enmeshed are the result of a variety of complex factors and because our industry has for years been the target of a very vocal minority, the matter of presenting simple and clear-cut issues is not easy. And a passion for preciseness and accuracy will obscure the issues and becloud the alternatives.

In presenting a simplified issue, a lack of preciseness or accuracy should not be cause for concern so long as the basic approach is honest. The story must be simple enough to persuade easily the intellectually lazy and honest enough so that those who investigate further cannot accuse us of sharp practice.

In persuading an audience to choose your side, there are basically only three approaches. You must convince them that you are the victim of unfair treatment—the audience always cheers the underdog—that your opponent is a villian whom they will be happy to help you foil, or that you are asking them to be in favor of something that is in their own selfish interest.

For the moment, the vocal minority has pre-empted two of these approaches. They have created the fiction of the villainous purple power trust, and they have assured the public that only their efforts will result in lower rates.

That leaves us only the approach of being the victim of unfair treatment.

Our opponents have done such a good job on the rate situation that it doesn't make any difference what our rates are, they are too high. If you don't believe this, ask a few average customers why they don't heat their homes with electricity. In nine cases out of ten the answer will be—the rate's too high.

If you ask the same customers why they don't drive a Cadillac, the answer will be—they can't afford one.

Now, notice the difference. The customer probably wants the Cadillac more than he wants electric heating, but he philosophically accepts his inability to have it—and he doesn't blame it on General Motors. But when he says, "The rate's too high," he is indicating that it is the utility's fault that he hasn't got something he thinks he is entitled to.

If we are going to persuade these people to help us, we must first convince them that not they, but we, are being unfairly treated. And here, again, our opponents have made the task harder.

Because every statement made by any spokesman for the utility industry is suspect in the minds of many people, simply because they have no faith in the integrity of the spokesman. He is a tool of the villainous purple power trust.

People will not be persuaded to help until they are convinced that we are deserving of help. And they cannot be convinced until they give credence to what we say.

In doing our task, it is essential that people be made to realize a corporation is a device for pooling the savings and skills of many people to provide products or services for the benefit of the customers which could not be provided by individuals themselves. And that the manager's job is to coordinate the interests of the people who provide the savings, supply the skills, and purchase the product or service in a way which will produce maximum benefits for all. And when customers believe that managers do this, they will place more confidence in what these managers say.

There Are Three Messages

Now, if we assume that we are in a position to deliver advantageously the message, we must decide what that message is.

It would seem there are three messages. One is that we are subject to the universal economic laws. The second is that the regulatory processes which so vitally affect our economic health should be conducted in as objective and unemotional an atmosphere as possible. And finally, that the goal of the proponents of the political power monopoly, which is obviously bad for us, is bad for the community and our customers who are citizens of the community.

These messages overlap and intermingle to such an extent that they are, perhaps, but variations on a basic theme. But if all will present the basic theme with consistency, the efforts of each will be enhanced.

It should not be too difficult to do this if we will do it in simple language, using simple parallels—and keep on doing it. In our industry we tend to become bored with our own commercials and to abandon them before they can become fully effective.

In telling the price story, we can, as we have done, point out that our prices have actually declined during an inflationary cycle. But this is not enough. Statistics to the contrary—the customer knows his bill is going up and that is what concerns him.

Customers Are Reasonable

Our customers are not so unreasonable as to expect that their bill will not go up when they use more energy. That is, they won't if they realize that that is what they are doing. But they don't.

So we must go back to the beginning. We must show our customers that the energy we sell substitutes for ice in the refrigerator, fuel in the range and water heater, the housewife's own muscular energy in the vacuum cleaner or washer, etc.—and that they have a choice as to which kind of energy they will use.

We must make clear to them that they have the same freedom in making these buying decisions as they have in buying an automobile. And they, and only they, can decide whether or not they can afford Cadillac comfort and prestige.

In dealing with the political power monopoly, our message, though based upon facts, requires more dramatic treatment if we are to succeed. Here is where, indeed, we must be sure that our "rousepower" is adequate for today's needs.

Meet George Armstrong: Louisville Gas & Electric's Hard-Working Chief

His first LG&E job came "of necessity" during the depression following World War I. He was a construction "roustabout"—teaching math on the side

The first year George R. Armstrong was with Louisville Gas & Electric Co, he worked from 8 in the morning to 11 at night.

He had two jobs: teaching math at a Louisville high school in the daytime and working on an LG&E construction crew in the evenings.

He gave up teaching after the first year, but has held onto long hours. Now he gets to work at 7:15, long before the telephone starts ringing and visitors begin arriving. He stays until well after five. It's a habit he acquired in his many years with LG&E's construction department.

"I've always gotten up early. I liked to see my construction jobs in the first hour—as well as the last—of each day. That way I could tell how they were going," he says.

Until the last few years he inspected the company's properties on Saturdays, Sundays, and holidays. Recently, frequent business trips have cut his inspections to about two a month. But he still makes them every chance he gets. "To me, a clean power plant is a work of art," he states.

His first job with Louisville G&E came as something of a necessity.

In 1921, after gaining his chemical engineering degree from Rose Polytechnic Institute, he ventured with his brother in the cotton gin business in Oklahoma. That didn't pan out, so he went looking for another job.

He landed one at Louisville Male High as a math teacher. That was in July, 1922. The term didn't start until September and his first pay check wasn't due until October.

"That was the year of the post World War 1 depression and I had to eat. Jobs were hard to come by but I got on as a sort of roustabout with an LG&E construction crew."

His ability didn't go long unrecognized at either job.

His Stadium Triumph

While he was teaching at Male High, the stadium where the school's Thanksgiving game was to be played burned. Tickets already had been sold. The principal suggested that Armstrong try to divide the space of the school's own smaller stands to correspond with the larger stadium so none of the ticketholders' money would have to be refunded.

The young teacher did. Each ticketholder got a space 11 inches wide for the game.

No money was refunded.

His Gas-House Despair

Meanwhile at LG&E, Armstrong had worked up from laborer to superintendent of the Beargrass gas plant within a year.

With a smile he remembers one incident of his early years in the construction department. He got an order to build a gas regulator house at a Park Avenue address, but didn't realize there were two Park Avenues in Louisville. The work was going well until the householder returned from vacation. Armstrong had picked the wrong Park Avenue. He had his crew remove the partially finished building amid apologies to the householder in whose backyard it was going up.

He was named construction superintendent in 1928 and was holding that job when the disastrous 1937 flood hit Louisville. He recalls the flood as "a challenge I wouldn't have missed for anything." He didn't get home for three weeks.

In 1939, Armstrong became assistant general superintendent of LG&E. Within a year he was general superintendent. He was elected to the board in 1946 and two years later was named executive vice president. He became president in May to succeed the late T. Bert Wilson.

Armstrong was active in organizing Ohio Valley Electric Corp and its subsidiary, Kentucky-Indiana Electric Corp. These firms, formed by 15 utilities, built generating plants at Madison, Ind., and Cheshire, Ohio, to provide power for the Atomic Energy Commission plant at Portsmouth. Armstrong, who had a hand in the location, design, and financing of the plants, is a vice president of KIEC and a director and executive committee member of OVEC.

Armstrong, a friendly man of 58 who rarely raises his voice, has no hobbies other than work. "There is no substitute for that," he says.

He and his wife have no children. But although he is reluctant to discuss it, his associates tell of the help he has given the children of employees, getting them through school and started in life.

His view of the utility business is an uncomplicated one: "We have nothing to sell but service. Our problem is to provide the best service at the lowest cost."

How to Minimize System Stability

Relay and planning engineers must share responsibility of solving problems posed by transient stability limitations

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Transient stability limitations occasionally pose special problems on expanding utility systems. Relay and planning engineers must share jointly the responsibility of establishing system design and relaying practices which will minimize these problems.

Typical cases in this article demonstrate the effects of loading, distance, system configuration, and relaying on stability margins. Control of systems when stability has been lost is also discussed. Although relaying can be used for splitting a system and for load dropping when instability occurs, it is best to avoid these last-resort measures, if possible, by proper system design.

Certain system design practices, if carried too far, can jeopardize transient stability. For example, it is sometimes desired to operate a newly developed high-voltage transmission system in parallel with the older portion of the system. In such instances care should be taken to insure that trip-out of a new facility will not impose extremely heavy power transfer requirements on the underlying lower voltage system.

Also, the splitting of systems or the use of reactors to reduce circuit breaker interrupting duties can be carried too far from a stability viewpoint. Similarly, the opening of a loop system at an awkward location can result in extremely high transfer reactance when the power flow must re-route itself over abnormally long distances.

Transmission system loadings are often expressed in terms of surge impedance loading, which is merely a convenient "per-unit system" base for transmission work. A line loaded at its surge impedance level operates at essentially unity power factor, its I^2X reactive losses being supplied exactly by the inherent shunt capacitance of the line.

When a transmission line is loaded in excess of its surge impedance loading value, the increased I^2X losses must be supplied by the source generators and the receiving system. The kilowatt loading corresponding to 1.0 per-unit SIL (surge impedance loading) is about 2.5 times the square of the line-to-line voltage in kv. SIL for the usual transmission voltages are (for single-conductor-per-phase construction):

Kv	SIL, Mw
69	12.0
115	33.0
138	47.5
230	132.0
345	298.0

For two conductors per phase in a bundle, the above values of SIL increase about 25%.

The economic power limit for short distances is determined primarily by the cost of power and

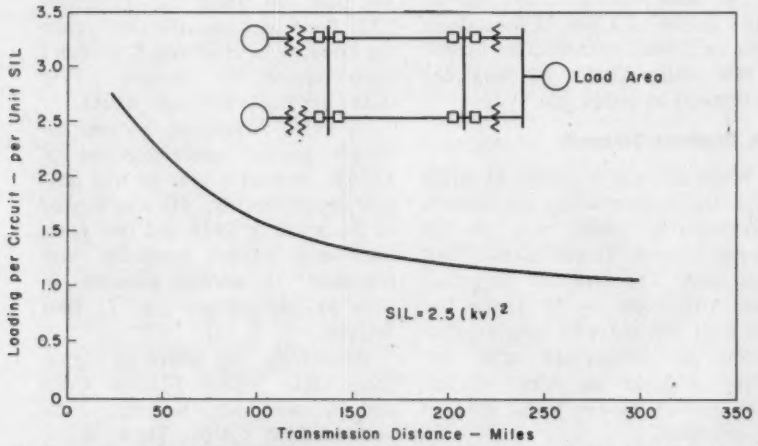


FIG 1—APPROXIMATE ECONOMIC power limits shown here can be obtained on a 2-circuit transmission system with faults cleared in 3 or 4 cycles and with intermediate switching stations for transmission distances of 100 miles or more

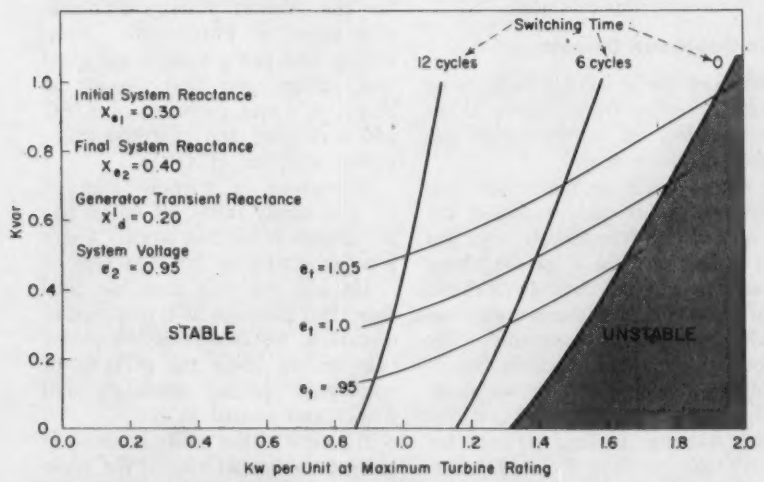


FIG 2—CURVES SHOWING EFFECT of switching time on 0.3-0.4 system transient stability limits point up obvious advantage of fast clearing. They indicate the gain in permissible loading of a generator serving a low-reactance system

Problems

energy losses and the ability of the system to supply the relatively high reactive losses incurred during emergency operation with one circuit out of service. For greater distances transient stability is the determining factor.

Values shown in Fig 1 are representative of the firm loadings which can be obtained on a two-circuit transmission system with faults cleared in 3 or 4 cycles and with intermediate switching stations for transmission distances of 100 miles or more. Basically, the intermediate switching station increases transient stability margins by reducing the transfer impedance when a faulted transmission link is switched out of service.

Usually transient stability problems are associated with the occurrence and removal of a system fault. Under extreme conditions, however, stability can be threatened merely by switching out a system tie which increases external reactance between source generation and the receiving system. Increase of fault-on (clearing) time decreases stability margins because it extends the period of system shock. Conversely, stability margins can be increased by speeding up switching time.

Fast Clearing Important

The advantage of fast clearing is demonstrated by Fig 2. This shows the gain in permissible loading of a generator or generating station serving a low-reactance system as switching time is cut from 12 to 6 cycles to instantaneous. The latter condition is equivalent to switching out an unfaulted facility which merely increases the system reactance. The 0.3-0.4 system designation refers to per-unit system reactances as viewed from the generator terminals before and after switching out a transmission circuit using maximum turbine rating as base. These system reactance values correspond generally to the upper limit of those to be found in a metropolitan-type system.

Fig 2 indicates that transient stability can be maintained in this case with switching times as long as 12

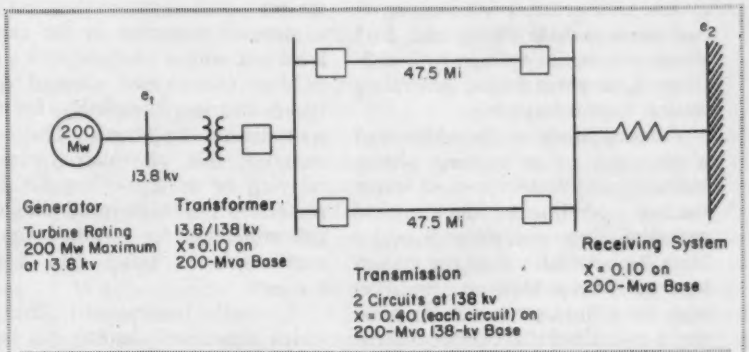
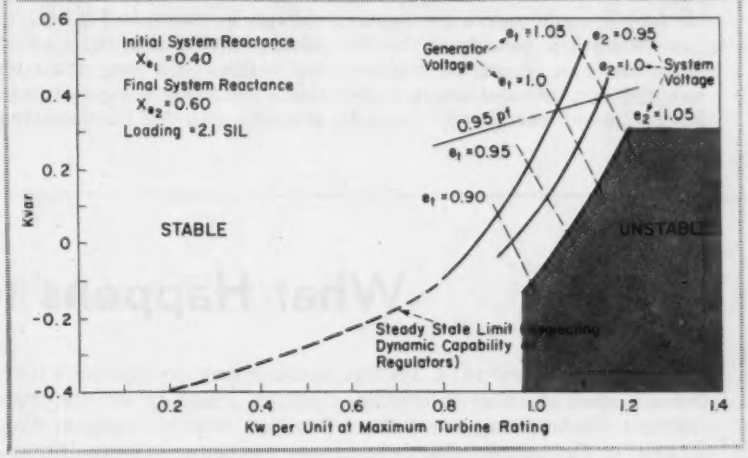


FIG 3—SHORT TRANSMISSION (above) reduces to 0.40-0.60 equivalent system, but stability (below) requires good voltage with 6-cycle clearing



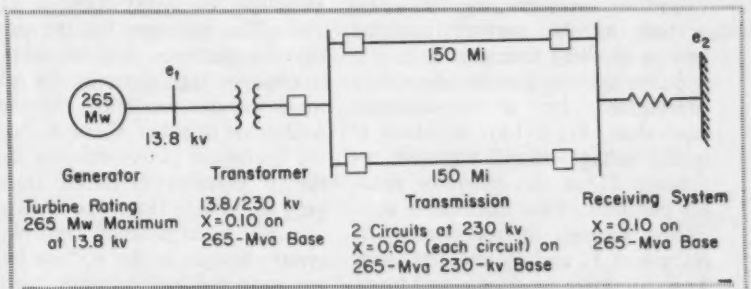
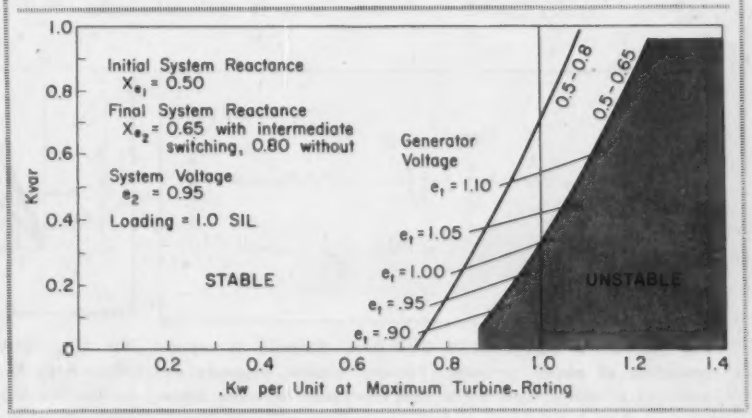


FIG 4—INTERMEDIATE SWITCHING cuts long system (above) to 0.50-0.65 vs 0.50-0.80 and with 6-cycle clearing aids transmission stability (below)



cycles, with generators operating at maximum turbine rating and 1.03 per-unit terminal voltage with a 3-phase fault close to the generating station high-voltage bus.

A recent study of the addition of a generator to an existing system indicated that under the most severe loading conditions the critical switching time was about 9 cycles for a 3-phase fault near the station bus. As 9-cycle back-up protection may be a little too much to hope for, a calculated risk exists concerning failure of first-line relaying.

With 3-cycle breakers, 15-cycle back-up protection is readily possible for the more severe contingencies. When it is considered that 3-phase faults on or near the bus are rare and that the most severe loading conditions occur only part of the time, it is apparent that there is a material reduction in the calculated risk with a 15-cycle back-up.

Many utilities have adopted high-speed clearing completely for the transmission backbone. They accomplish this with carrier-current relaying or its equivalent for line protection and high-speed differential protection for terminal equipment such as buses and transformers.

A short transmission link to which high-speed clearing has been applied is shown in Fig 3(a). One requirement for stability on this line, with 6-cycle clearing, is good voltage, as shown in Fig 3(b). The effect of adding intermediate switching stations to a long transmission line is illustrated in Fig 4(a) and (b). It can be seen that intermediate stations enhance transmission stability.

A fault in a transformer-protected zone can be just as great a hazard to the system as a line fault. A bus fault usually will be an even greater hazard. Thus, the protection for terminal equipment must be at least as good as that provided for lines.

The use of high-speed protection throughout reduces the need for frequent studies, avoids duplication of engineering, and provides maximum over-all system reliability by reducing the possibility of permanent faults.

Inception of a fault initiates power swings which could cause undesired relay operation even though stability were maintained. Unwanted line trip-outs during power swings can be avoided by selecting relay settings which are adequate to per-

What Happens to System Stability

Transient stability of a system depends upon its ability to develop sufficient synchronizing power after removal of the faulted transmission circuit to overcome angular acceleration of the various machine groups resulting from the fault.

Many systems can be adequately represented by a two-machine equivalent, Fig 5 (a), in which e' is the voltage behind transient reactance X'_d of the generator nearest the fault. This machine is connected through its transformer of reactance X_t and system reactance X_s to all other generation and loads represented as an "infinite" system bus at voltage e_2.

Power transfer from the generator to the system depends upon the two voltages e' and e_2, and the angle δ' between these voltages, as well as the reactance between them, as shown by the heavy curve in Fig 5 (b). The equation for the power transfer discloses that an increase in either voltage increases the maximum transfer capability. Similarly, a decrease in either X'_d or X_s boosts the maximum power transfer capability. Usually, of these factors, only the system reactance X_s is susceptible to significant control by system design, as the voltage levels are restricted by operating considerations and the available variation in machine and transformer reactance is ordinarily quite small.

If a 3-phase fault occurs so that no electrical power can be transferred from the generator, the mechanical power input, P_i, to the generator accelerates the rotor causing e' to advance in an angular position with respect to voltage e_2, whose angular position is assumed to remain fixed. This acceleration continues until the fault is cleared, increasing the angle δ' between the two voltages.

When the fault is cleared, the electrical power output from the generator rises immediately to a value determined by a new power-angle curve and the new angle δ_c' which the generator voltage e' has reached during the fault-on time.

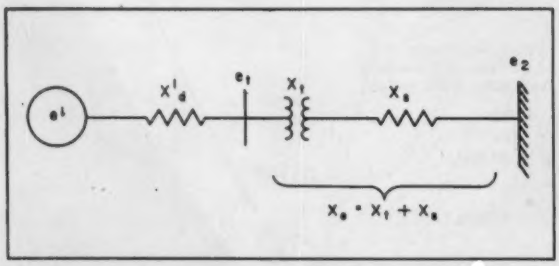


FIG 5(a)—THIS EQUIVALENT 2-machine diagram is representative of many systems. Power transfer depends on voltages e' and e, and angle and reactance between them

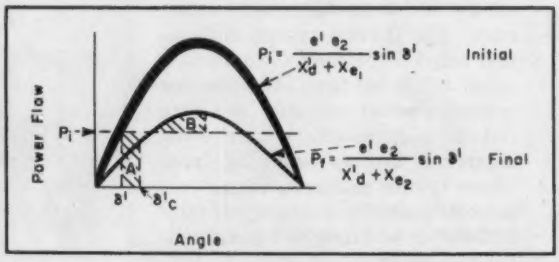


FIG 5(b)—STABILITY is attained, after removing a fault, when Area B, decelerating energy, equals or exceeds Area A, accelerating energy, in these power-angle curves

mit the line to carry the maximum transfer required under emergency conditions. This may mean changing some practices that were acceptable when the system was smaller.

If a fault is not cleared by the normal first-line relays and breakers, then it must be cleared by operation of remote breakers in circuits feeding the faulted line. If the relays at the remote ends of the lines feeding the uncleared fault can be set sensitively enough and are fast enough to detect the fault and yet not limit the emergency performance of the transmission system, then this method of securing back-up is adequate.

On modern transmission systems, however, it may be impossible to achieve sufficient sensitivity without conflict with the requirement that each line carry its maximum transfer under emergency conditions. Or, under extreme conditions, it may be impossible to clear a fault by remote back-up relaying fast enough to preserve stability. Under these conditions local back-up, consisting of back-up relays in the faulted circuit arranged to trip the bus feeding the faulted circuit, would be applicable.

What a specific relay system will do when the power system is unstable may require a long network analyzer study. But some generalizations may be helpful. Overcurrent relays (which probably have no place on a transmission system) may cause indiscriminate tripping which is almost impossible to forecast. Distance relays will cause tripping whenever the voltage and current relations fall within the operating area. The performance for any particular case can be predicted accurately from an analyzer study.

Carrier-current relays provide some choice. The phase-comparison-type will not trip during either a power swing or an out-of-step condition, but back-up relays supplementing the phase-comparison may cause undesired tripping unless some form of blocking is used.

Directional-comparison carrier relaying will trip a line section spanning an electrical neutral, several of which may exist in case of a major system disturbance. However, supplemental features are incorporated in a terminal so that directional-comparison relaying can either prevent tripping or permit tripping and block reclosing.

When 3-Phase Fault Occurs?

The final power-angle curve is usually smaller than the initial curve as indicated in Fig 5 (b) because removal of the faulted circuit increases the external reactance. Thus, X_{e2} is greater than X_{e1}.

Areas A and B are proportional to energy (power or torque times angle). Area A represents accelerating energy; B, decelerating energy since electrical power output exceeds mechanical power input P_i. For stability, Area B which is bounded by the limits of the final power-angle curve and initial power, P_i must equal Area A.

For a given set of system constants and operating voltages, an increase in either P_i or the fault-on period increases Area A and makes maintenance of stability more difficult, other factors being equal. Similarly, an increase in X_{e2} threatens stability because it reduces the available area for decelerating energy.

Transient stability limits can be plotted conveniently as in Fig 5 (c), which shows the initial operating limits for a generator to maintain stability with a 3-phase fault close to the generator high-voltage bus. This set of curves represents a system having initial external reactance X_{e1} of 0.2 per-unit based on maximum turbine rating. The various "Limit 4" curves are for different values of final system reactance X_{e2} after clearing of the fault in 6 cycles. Initial operating points to the left of the appropriate curve denote the stable operating region; points to the right are in the unstable region.

These curves demonstrate the importance of final system reactance X_{e2} upon stability and the influence of generator operating voltage e_t.

The use of generator voltage regulators is assumed in all of the transient stability limits presented.

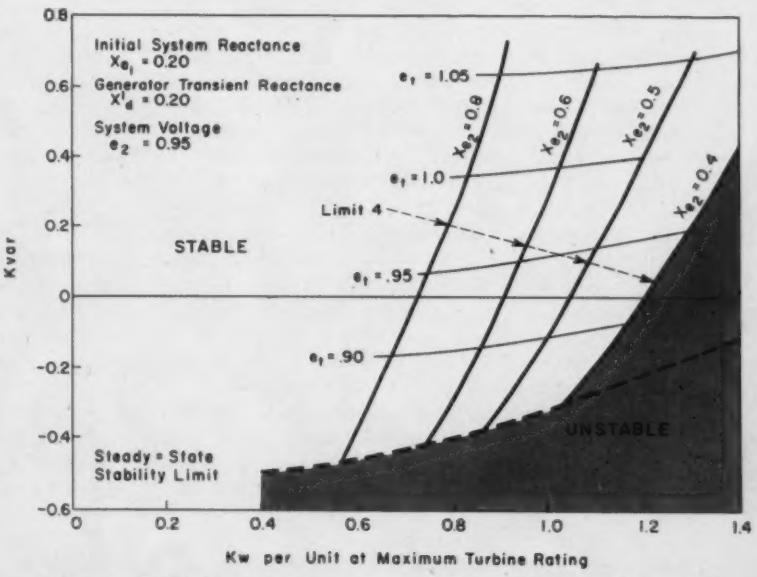


FIG 5(c)—IMPORTANCE of final system reactance X_{e_2} on stability is demonstrated by curves showing how stability limits can be plotted conveniently

Experience Backs Bushing Standards

- Utilities realize many economies from bushing interchangeability between apparatus, a result of 25 years of planned standardization
- Forthcoming ASA standards can provide additional savings from interchangeability and can give a still higher degree of reliability

A. W. HILL, Manager, Power Circuit Breaker Engineering, Westinghouse Electric Corp, E. Pittsburgh, Pa.

Bushing interchangeability can provide economies without sacrificing dependability. These economies and the safety of interchangeability will be enhanced when the forthcoming ASA bushing standards for outdoor circuit breakers and transformers, 115 to 230 kv, are adopted and applied to the full.

Bushing interchangeability between certain classes of apparatus has been used by the author's company with dimensions unchanged for 25 years. Many economies have been realized through use of only one spare bushing for a variety of breaker and transformer units. This feature was not provided by accident—it was planned policy, wisely chosen and vigorously pursued.

More than 95% of the 80,000 bushings produced during the past 25 years had only one set of dimensions for each voltage class. Even when current ratings were increased from 400 to 600, to 800, to 1,200, and often to 1,600 amp, no change was made in dimensions. Value of these bushings at present prices would be more than $150 million.

Same Overall Dimensions for 25 Years

Important detail improvements in manufacture have been made through the years, but the overall dimensions—length, diameter, terminal size, bolt circle, flange gasket, CT pocket, potential tap—remained unchanged. Consequently, a single spare bushing could be used without costly or awkward adapters in breakers or transformers regardless of date of manufacture.

This interchangeability will be advanced by the proposed ASA standard. The safety and reliability of this proposal can be determined by considering, for example, the new 115-kv, 1,200-amp ASA bushing. It would be used in a breaker having an interrupting capacity of perhaps 5,000 Mva. Its flange is laid out for six ¾-in. bolts on a 13¼-in.-dia bolt circle. The gasket face is 9⅞ ID by 11⅞ OD.

The bushing used for 25 years in such applications had practically the same gasket face—9¾ ID by 10¾ OD. It had a 14-in. bolt circle of eight ¾-in. bolts and rested on a conical seat in the circuit breaker tank.

The fewer bolts on the new design are entirely adequate. The rocking adjustment at this point in the older design has been superseded by a fixed flat-seat gasket which improves stability of mounting.

Reliability is not sacrificed either. The greatest diameter of the bushing below the flange is one measure of its electrical strength. Of course, this dimension should be chosen with the recognition that small diameter means lower cost although reliability may indicate a larger diameter. But the choice of 8¾ in. for the proposed ASA bushing is the same dimension used for many years on bushings which have never failed in service by puncture.

Insulation length under oil—not tabulated on the proposed ASA standard but easily determined from overall length and CT pocket depth—is 18½ in. for the new ASA design. Bushings having an insulation length of as little as 16¾ in. have been in service at this voltage for some 30 years. Their successful operating record justifies the proposed design.

Bushings Get Exhaustive Tests

Mechanically, bushings with these design dimensions have been put through exhaustive high power laboratory tests and have accumulated field experience since this Mva rating was established for breakers in the early 1950's. They have withstood this test and operating experience without a single failure.

The space allowed for current transformers is also important, and quite often breakers are equipped with two current transformers per bushing. This is no new feature—it has been done regularly for 25 years.

The ASA proposed relationship of flange design also matches exactly the relationship found in bushings used for 25 years. Electrical integrity of the apparatus requires that the bushing ground flange extend to the bottom of the current transformer case. A safe and economical bushing design is closely associated with the length and diameter of the flange or ground foil layer of the condenser.

Identical Leads on Potential Device

Although a standardized design of potential tap outlet has not yet been recommended by the ASA standards committee, the value of standardization has not been overlooked in the past. Every interchangeable bushing from 115 to 230 kv and higher employed for 25 years the identical lead connection to its potential device. Not once in this period has it been necessary to depart from this detail.

Moreover, the potential device lead-in cable has likewise retained the same terminal design and even the same 33½-in. length. And the potential device itself (at least 7,500 of them now in service) has been available in only one design, except for one alternate choice in primary capacitance, for the highest voltage applications.

A SPECIAL REPORT

Residential • Commercial • Industrial

New Look In Outdoor Lighting

It's headed

- Toward higher ft-candle levels
- Newer, more efficient sources
- New applications in home, farm, shopping center and factory

Because

- Shift to suburbs has taken lighting along with it
- Lighting is blended right into architecture
- More use as a merchandising and selling tool by dollar-conscious retailers
- Factories use more for safety, advertising and appearance
- Utilities "re-adopting" lighting as a good load builder

A Full Report Follows on the next 15 pages:

This report, dealing with residential, commercial, and industrial outdoor lighting, makes no mention of street and highway lighting. It is the editors' feeling that this latter subject, because of the way it is sold, installed, and serviced, is, from the utilities' viewpoint, more properly the subject of a separate study.

T. R. JORDAN Commercial Editor

Outdoor Lighting Follows Changing Pattern of Our Living

The changing pattern of American living since the end of World War II has brought about a revolution in all types of outdoor lighting—a revolution that bodes well for utilities and manufacturers alike.

The big changes center around two main trends: (1) the shift from the big cities to the suburbs, and (2) industry's decentralization.

The rise of the large "packaged" villages in the suburbs gave birth to the one-stop shopping centers with their huge lighted parking lots and floodlighted stores. Chain Store Age figures there are some 1,500 centers in the U. S. now and an equal number on the drawing boards. Store owners in these centers are using outdoor lighting as they use light in their shops: As a selling tool, and not merely for illumination.

Gas stations, in tough competition for the driver's dollar, have gone to outdoor lighting as a customer-puller. More than 180,000 are possibles in this market. Their number is not expected to increase much, but they'll be increasing in station size, modernizing, and general upgrading. Small commercial enterprises—restaurants, wholesalers, distributors, and others—have been calling attention to themselves and their businesses with electric signs, floodlighted buildings, and other outdoor lighting schemes.

Outdoor Living Accentuated in Suburbia

With the exodus to Suburbia has come the accent on outdoor living. This created the "climate" for outdoor residential and garden lighting. New architectural styles also played their parts. The use of glass for large wall areas practically made driveway and garden lighting imperative in order to see out of the house at night.

In this outdoor residential market, garden lighting seems the biggest market by far. Hence, its emphasis in this report. Utilities have been slow to recognize the possibilities out in the flower bed. Usually, they argue, they are hampered by geography or climate; or they want to go after the bigger loads. Garden lighting can be regarded and sold (indeed, it should be!) as merely another part of the ever-increasing residential load. As is the case with other residential lighting, it has a good load factor.

Manufacturers, like the family, have also moved out of town. The reasons:

- Changing market and distribution setups
- Unfavorable taxation in urban areas
- Needed room for expansion
- Lower labor and transportation costs
- In the new community, the manufacturer wants to be regarded as a "good neighbor," so he makes his plant as attractive as possible. New thinking in architectural design tries to relate both indoors and outdoors: To give the plant and its surroundings a unity. Outdoor lighting becomes an integral part of the planning, not something merely tacked on as an afterthought. Power companies must assist new manufacturers in the outdoor lighting plans *before* the plants are actually constructed.

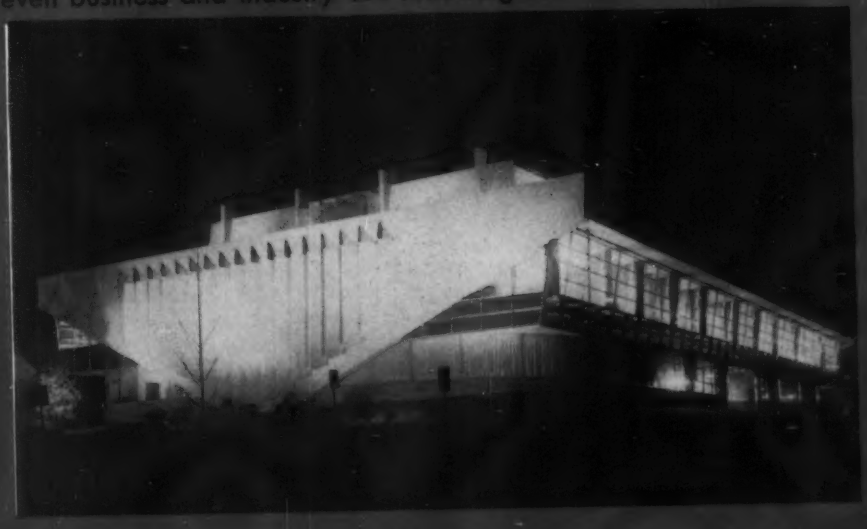
Intensity levels in outdoor lighting are increasing. Newer, more efficient mercury and fluorescent sources are the reason for this. Utility interest in outdoor lighting is slowly reviving from the coma it has been in since the last war. Some think it is in for a renaissance, approaching its pre-war interest peak. Generally, the power companies have been preoccupied with new, larger, and perhaps more "glamorous" loads. Even a cursory study of the load factor of residential lighting vs that of some appliances will indicate how much has been lost through indifference or downright neglect of lighting.

In the preparation of this report, much credit must go to those utilities, manufacturers, and associations which have helped. Particular thanks goes to General Electric Co's Nela Park and Outdoor Lighting Dept at Hendersonville, N. C., Lamp Division of Westinghouse Electric Corp, Line Material Industries, Edison Electric Institute, Metropolitan Edison Co, Hawaiian Electric Co, Port of New York Authority, and National Petroleum News. Without their assistance, this report would have been impossible.

. . . with the huge shopping centers in Suburbia,

. . . and its accent on home out-of-doors activities,

. . . even business and industry are following suit



Garden Lighting: A Residential Plum

Today's biggest outdoor lighting plum lies in America's gardens. Main reasons for this are (1) the swing to outdoor living, and (2) the new architecture, which integrates the house and its surrounding plot into one design-for-living.

The market is there and is definitely growing. William Eppard, president of Kim Lighting, Inc, a garden lighting manufacturer in California, reports equipment sales up 40 to 60% over 1956. Similar reports come in from other parts of the country. Says General Electric Co's J. C. Forbes, manager of its Large Lamp Department: "In 1952 there were only five manufacturers of outdoor lighting equipment for residential use. Today there are 50 manufacturers producing equipment for this market, reflecting an increasing demand for outdoor lighting fixtures."

There are an estimated 30 million gardens across the country. Probably the best way to get to them is through the 11,000 garden clubs in 44 states. Lighting is one of their chief interests. "Directory and Handbook," a publication available to all clubs, lists 27 subjects for club discussions. First two concern lighting.

Power companies are waking up to garden lighting load possibilities. It's a good steady off-peak evening load that comes on just as air conditioners are being shut down. Little or no data is available on the market size, but here's what a thumbnail sketch reveals:

Informed sources put the reasonable garden load at about 1 kw. This load is on an average of 4 hr a night, 15 nights a month, 4½ months a year. Yearly kwhr consumption, therefore, is 270. Now multiply this by 30 million gardens—for 8,100,000,000 kwhr. Average residential rate in 1956 was 2.59¢, and estimated annual revenue comes to $20.1 million!

Garden Lighting Has Its 'Bugs'

But the picture has its "bugs." Biggest problem is that there are no "experts" . . . or very few anyway. Another big question: Who makes the equipment, and where can it be bought? Manufacturers, most of them small, have been painfully silent. A partial list of who makes the stuff has been compiled on the opposite page.

Equipment costs are still too high. General opinion in the industry is that these will have to be brought more in line before promotion will show results.

Utilities also must do more. In fact, if garden lighting is to be sold at all, the power companies are going to have to carry the ball for it. GE's Nela Park garden lighting specialist Al Gilliland says, "Utilities must spearhead the garden lighting drive. Only then will

Manufacturers of Equipment for Garden and Patio Lighting

Cannon Electric Co.
Los Angeles, Calif.

Decora Designs, Inc.
Miami, Florida

Esty Mfg. Co.
Chicago, Illinois

Feldman Co.
Los Angeles, Calif.

Fostoria Pressed Steel Corp.
Fostoria, Ohio

Industrial Lamp Corp.
Elkhart, Ind.

Kim Lighting
Pasadena, Calif.

Lawn-A-Lite
Cleveland, Ohio

Lightolier, Inc.
Jersey City, N. J.

Ludlow Studios
New York, New York

Markel Lighting Prod. Inc.
Buffalo, N. Y.

Natur-a-Lite Co.
Los Angeles, Calif.

Paramount Industries, Inc.
New York, N. Y.

Progress Mfg. Co.
Philadelphia, Pa.

Rinehardt-McArthur Co.
St. Louis, Mo.

Riviera Lamps
Ft. Lauderdale, Fla.

Shalda Mfg. Co., Inc.
Burbank, Calif.

Standard Novelty and
Lamp Co. Chicago, Ill.

Steber Mfg. Co.
Broadview, Ill.

Teal Corp.
Irvington, N. J.

Moe Light
Louisville, Kentucky

Verplex Co.
Essex, Conn.

Weber Brothers Metal Works
Chicago, Ill

Wolfe Lamp Corp.
New York, N. Y.

Manufacturers of Spike and Bracket Type Par-Lamp Holders

Appleton Electric Co.
Chicago, Ill.

Brettford Mfg. Co.
Franklin Park, Ill.

General Electric Co.
West Lynn, Mass.

Hildy Products Co.
Milwaukee, Wisc.

Killark Electric Mfg. Co.
St. Louis, Mo.

Magni-Flood
Mount Vernon, N. Y.

Moldcast Mfg. Co.
Newark, N. J.

Prescolite Mfg Corp.
Berkeley, Calif.

Ray Kuehn Mfg. Co.
Newark, N. J.

Spero Electric Corp.
Cleveland, Ohio

Stonco Electric Products Inc.
Kenilworth, N. J.

Swivelier Co.
Brooklyn 12, N. Y.

Plastic Bubble Diffusers

Artcraft Specialty Co.
Wilkes-Barre, Pa.

Lam Workshop
Wakefield, Mass.

Lightolier, Inc.
Jersey City, N. J.

Luminart Lamp Shade
Products, Inc. N.Y., N.Y.

Underwater Lights

Kim Lighting
Pasadena, Calif.

Russell & Stoll Co., Inc.
New York 7, N. Y.

Shalda Mfg. Co., Inc.
Burbank, Calif.

Westinghouse Electric
Corp. Cleveland, O.

NOTE: This list of manufacturers of garden lighting equipment is furnished for convenience. It does not pretend to be complete. It in no way implies any preference or endorsement. If some names have been omitted, it was because those names did not appear on the lists to which the editor had access.

results be forthcoming." And Westinghouses' Myrtle Fahsbender: ". . . Where utilities and dealers have worked hand-in-hand there have been favorable results . . ." Here are some agreed basic points around which to build a garden lighting program:

- Resolve internal conflicts regarding the residential market generally. It is still the largest one.
- Use women to sell women. Train female specialists (home economists, maybe?). Work with womens' and garden clubs.
- Help manufacturers line up distributors and retailers in your area.
- Tie in landscaping and trade allies.
- Know outdoor wiring code requirements. Variations make for different market conditions.
- Display and demonstrate equipment. Don't advertise until equipment is available.

Don't let geography stop you. True, garden lighting quite naturally got its start in areas having florid vegetation. But it is not staying there. Wisconsin Power & Light Co has an active, profitable garden lighting program. closely tied to its garden clubs. Cincinnati Gas & Electric is sending some $10,000 to push it this summer. Northern utilities are promoting it in winter; light on snow is stunning and saleable.

Bugs may be a problem. Best solution to date has been to use yellow lamps in frequented areas. Manufacturers claim yellow light is almost invisible to insects. Put the white light in shrubs or trees.

With America spending more time outdoors, it looks as if garden lighting is here to stay. Utilities should look to it as a good load builder and balancer.

Garden Lighting Grows

- Hawaiian Electric Co finds it ripe, and picks it with portable demonstrations right in the customers' back yard
- Program, now three years old, averages 76% sales in all demonstrations.
- Public relations 'fringe benefits' are many as stores, contractors sell lighting better
- Company follows up demonstration with blueprints, makes it easy for customer to buy

STANLEY SKUK, Residential Lighting Consultant, Hawaiian Electric Co, Ltd, Honolulu, T.H.

Hawaii is surely an ideal setting for outdoor garden lighting. But it has one serious flaw—its own perfection.

So lovely are Hawaii's home gardens under the moon and in the flickering glow of the islands' traditional garden torches, that it was difficult to visualize how outdoor electric lighting could possibly add to the beauty. That was the core of the sales problem faced by our lighting distributors and dealers. The moon was too tough a competitor.

Three years ago Hawaiian Electric Co, Ltd, in Honolulu, which already has been running a residential lighting educational program as part of its load-building activities, undertook garden lighting as a major area of load development.

We decided to build our program around three key promotion points:

Program Built Around Three Points

- Garden lighting should not be regarded as a pleasant accessory, but as an integral part of modern home lighting.
- It should be planned and blueprinted with the same care and accuracy as any interior lighting scheme.
- It must be demonstrated to show the prospective garden lighting customer how it will look in his garden.

This third point is what blocked distributor and dealer efforts; we realized that it had to be accomplished if our program was to be successful.

The answer was a personal, practical, free demonstration right in the customer's back yard.

An outdoor lighting "loan kit" was put together with portable equipment obtained from local suppliers. We made it a representative set of supplies, including all styles and sizes of fixtures available. When we got through, we had a traveling "lighting supermarket"—except that nothing could be bought from it. Everything

Among Hawaiian Palms

was displayed at its best—which is to say, in use.

Pointing up the varied moods that can be created by outdoor garden lighting, Hawaiian Electric's newspaper ads asked, "How Does Your Garden Glow?", and illustrated how it could be one garden by day, another by night. The ads invited readers to ask for a free home demonstration.

The calls came in, slowly at first, because no one could really believe that a public utility would send a specialist after working hours to show ways that lighting could enhance the beauty of an individual garden. However, some homeowners did call. We set up dates and times for demonstrations, and they were encouraged to plan an outdoor party while the lighting was in place. This, of course, showed off the lighting effects to their friends and neighbors.

Prior to the demonstration, our lighting specialist surveyed the garden, tried several variations of lighting layouts, then set up his portable equipment. This was followed in a few days by a complete set of blueprints, showing suggested locations and types of weatherproof fixtures and outlets.

Average 76% Sales Results

One demonstration stimulated another. Guests and neighbors requested plans for their gardens. The program began building up steam and producing startling sales results.

Last year alone—

Equipment was demonstrated to some 2,913 people at garden parties, barbecues and other outdoor home gatherings. Fully 76% of the demonstrations resulted in sales of permanent lighting installations!

More then half of all installation made by electrical contractors last year came as a result of the demonstrations.

Christmas produced a big outdoor lighting bonus. In an unexpected rush of buying equipment as gifts—attributed largely to Hawaiian Electric's program—the stocks of several electrical supply houses were completely sold out by year's end.

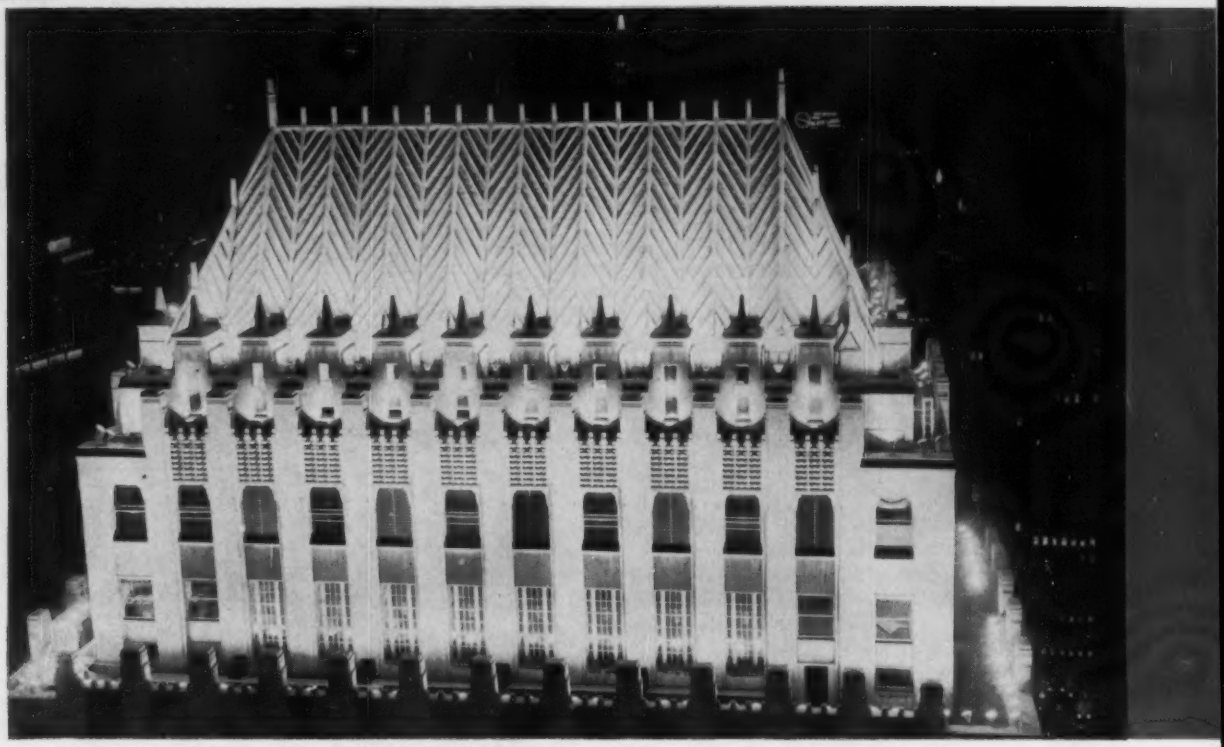
There has been a similar array of "side benefits" that have made the program as effective in its public relations value as in its sales success.

- **Retail lighting stores** are happy to eliminate the "hit or miss" method by which lighting equipment was previously purchased and stocked.
- **Contractors** are pleased because blueprints are ready for them to follow and they know exactly what the customer expects.
- **The homeowner** has been shown repeatedly that prior planning, blueprints and layouts have resulted in substantially lower installation costs.
- **Generally,** all parts of the industry here in the Islands have had a lighting sales lift.

Outdoor lighting demonstrations are today a regular part of Hawaiian Electric Co's promotion program. In its three years the program has made big strides, but there is still much ground to cover. Even in Hawaii, where matchless weather has helped create a great market potential and where the advantages of electric living have been so well sold that residential consumption is 37% above the national average, it still takes salesmanship to produce sales.

We are certain that the demonstrations-plus-blueprints formula is the key to our success.

To prove the point, we recall an appointment made by one woman who neglected to tell her husband. He was adamantly opposed, to say the least, until the demonstration got underway. Before the evening was through, it was he who was doing the experimenting. We made the sale.



Whether for tenants in downtown office buildings . . .

It's Outdoor Lighting That Pulls

The battle for commercial dollars in what the experts call "an economy of conspicuous consumption" gets fiercer each day. And outdoor lighting is right in the middle of it. Whether the competition is for tenants, between the older office buildings and the sleek shiny skyscrapers, or the downtown stores and the shopping centers, lighting is a tool they all use.

Pre-war office building owners, steadily losing tenants to their counterparts in the crisp, airy, steel-and-aluminum fingers pointing skyward, have had to build newer features into their aging structures to retain a competitive position. Air conditioning and face-lifting have been their main weapons. Along with the face-lifting goes outdoor floodlighting. No market figures are available on the number of office buildings in America that are suitable candidates for floodlighting, but experts agree it is high, and definitely worth looking into. Says GE's Monty Cutler, "Building floodlighting is undergoing a renaissance. Before the war, there was great utility and customer interest in it, and now it looks as though it's making a comeback." William Kahler of Westinghouse adds, "Building floodlighting is definitely on the way back toward its high point in the thirties. This time, though, it'll be different. Instead of merely throwing a mass of light against a building wall, the lighting will be selective. Architectural features will be highlighted." Good examples of this are the Koppers building in Pittsburgh and Cincinnati Gas & Electric's home office. This "selective" floodlighting is expected to open the market for more of the smaller structures, whose owners can't afford the massive effect.

Monument Lighting Needs a Push

Monument lighting, too, is on the upswing. But the trend to lighting public and civic structures is slow. Generally, utilities have not pushed it. GE's Cutler again, on this point: "We in the United States are tailing in this respect. Probably the leading country for monument lighting is France. Utilities there have crews equipped with portable rigs who go around the country lighting the points of interest ahead of the tourists." The job here is selling local city boards and chambers of commerce. Again, demonstration seems the way to do it.

Commercially, though, the big market is in the shopping centers and parking lots across the country. Latest

or suburban customers in big shopping centers . . .

The Commercial Dollars Today

figures put the number of shopping centers at about 1,500, with an equal number on the drawing boards.

But this also will have to be pushed. And utilities are not spending the money or manpower (EW, July 23, 1956, p 97). When it comes to the shopping centers, the power companies have an "in." Usually, they know in advance when a center is going up because they must provide service. It's at this stage—early in the game—when the outdoor-lighting pitch should be made.

Recreation and sports lighting is another wide open field. Again no figures for market estimates are available. But there are more than 125,000 elementary and secondary schools in the U. S. . . . most of them are likely candidates for schoolyard lighting. The same is true of parks, playgrounds, and swimming pools. Here utilities will have to make the contacts through local government bodies. Generally, they don't appear to be very aggressive in this field.

Gas station lighting also holds a lot of promise. Despite the relatively small increase in stations over the next 10 years, the market appears big because:

• Tough competition for the motorist's dollar is making more and more stations use outdoor lighting—in signs, building lighting, and driveway lighting.

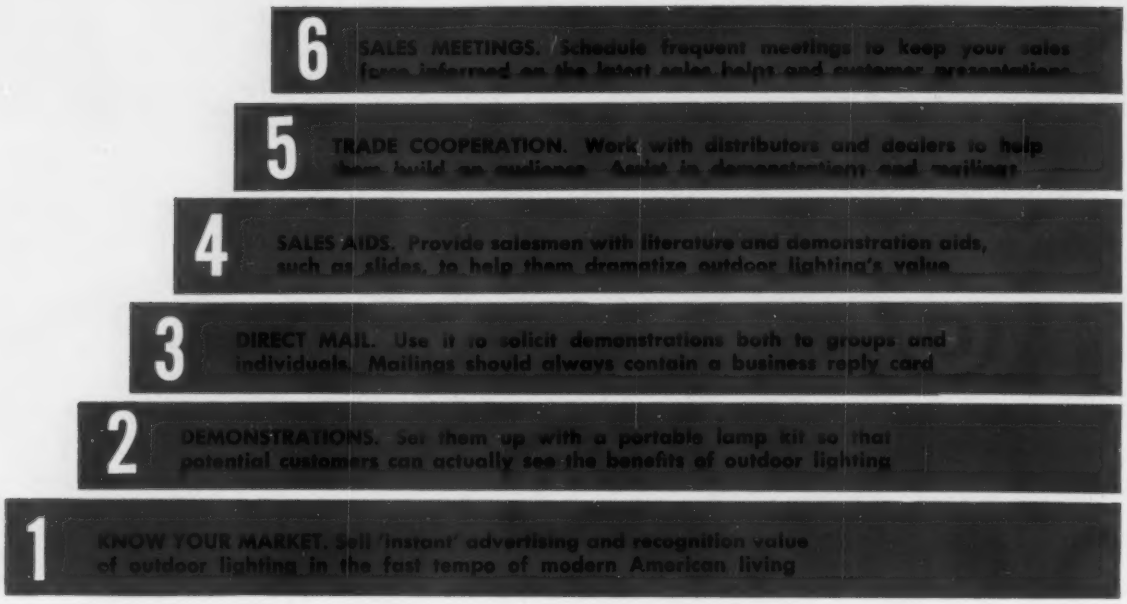
• Big problem is identification. Oil companies realize this, and are moving toward standardization of most station components, including outdoor lighting requirements and equipment. Best way to get at this market would appear to be through big oil companies themselves, who own or set the design standards for many stations.

Airports, or at least their terminal areas, seem to be undergoing an outdoor lighting facelifting. Witness high ft-candle effects of Milwaukee's new airport and decorative fountain at Cleveland. Biggest hunk of airport outdoor lighting is going in "Terminal City" at New York's International Airport (Idlewild). Idea is to light the area from the air as well as from the street.

No matter what the outdoor lighting application, one central fact as regards selling it emerges: It has to be demonstrated.

Commercial customers do not come crying for it, despite the fact that many need it badly for business. They have to be shown what it will do for them, and demonstration techniques, of one kind or another, are the best way to do it.

6 Points to Sell Commercial Outdoor Lighting


6 SALES MEETINGS. Schedule frequent meetings to keep your sales force informed on the latest sales helps and customer presentations
5 TRADE COOPERATION. Work with distributors and dealers to help them build an audience. Assist in demonstrations and mailings
4 SALES AIDS. Provide salesmen with literature and demonstration aids, such as slides, to help them dramatize outdoor lighting's value
3 DIRECT MAIL. Use it to solicit demonstrations both to groups and individuals. Mailings should always contain a business reply card
2 DEMONSTRATIONS. Set them up with a portable lamp kit so that potential customers can actually see the benefits of outdoor lighting
1 KNOW YOUR MARKET. Sell 'instant' advertising and recognition value of outdoor lighting in the fast tempo of modern American living

Demonstrate and Sell Outdoor Lighting

"Demonstration" is the sell-word when it comes to commercial outdoor and sign lighting at Metropolitan Edison Co and Pennsylvania Electric Co.

For two years now these two utilities have conducted a joint outdoor lighting campaign that centers around the premise: Your customer has to see what outdoor lighting will do for him before he'll buy it.

MECO-PENELEC developed a special portable rig (see illustration) made up of three 500-w reflector lamps to show owners of motels, gas stations, roadside businesses, diners, auto showrooms, garages, and others the value of outdoor lighting. They've done the same thing for "lighting-for-prestige" customers, such as country clubs, swimming pools, and resorts. Demonstrations are made to both individuals and groups.

Direct mail is another selling tool used to solicit customers. A reply card is always enclosed. Idea is to make seeing as well as buying as easy as possible.

MECO-PENELEC do not overlook their outdoor lighting allies, the area distributors and dealers. The utilities assist them in setting up and demonstrating equipment and by allowing them the use of their mailing lists. This kind of activity has paid off well.

The utilities' own sales people are not neglected, either. They get a continuous program of educational sales meetings, plus the latest sales aids, techniques, and customer presentations—all designed to help them tell the outdoor lighting story in the best "light."

How well has the demonstration technique paid off? In 1956 and 1957, a total of 624 demonstrations (individual and group) has added 1,841 kw of outdoor lighting load, averaging almost 3 kw per demonstration.

Outdoor Lighting Will Boost Gas Pump Sales

Service stations are turning hungrily to outdoor lighting to capture more of the motorist's dollar.

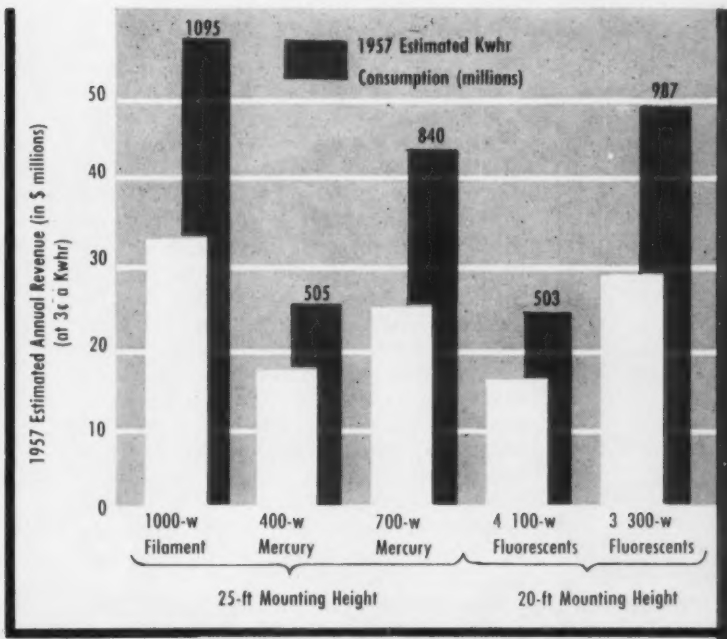
Trends in station design are aimed at the same goal. The keyword is "identification," and the big oil producers are going after it. According to a recent article in National Petroleum News, a McGraw-Hill magazine, "One sure thing about the station of the 60's: it will be hard to ignore. It will look massive, it will dazzle at night; in short, it will be an attention-getter."

General Electric Co and Cleveland Electric Illuminating Co have already worked out a service station formula—*area* × *brightness* = *attention*—designed to help the operator "separate" his station from surrounding competing areas. Lighting will be emphasized on driveways and pump islands. Curb-breaks will get big play. Driveways, most of them blacktop, will not be lighted above 1 ft-candle. Internally lighted or floodlighted signs and pylons will be the order of the day.

Most lighting jobs in stations will be rehabilitation ones, because expected increase in the number of stations in the next ten years is only about 1.7%.

Utilities will have to sell service station lighting through large oil companies marketing in their areas. Many stations are owned by them, and trend is to standardizing them. In 1957, 18 of these producers are spending $243 million on capital expenditures. Power companies will get their lighting share only if they act now. Because of most oil producers' setup, perhaps the best way to this market is through an industry service station lighting committee.

1957 Service Station Estimated National Kwhr and EAR



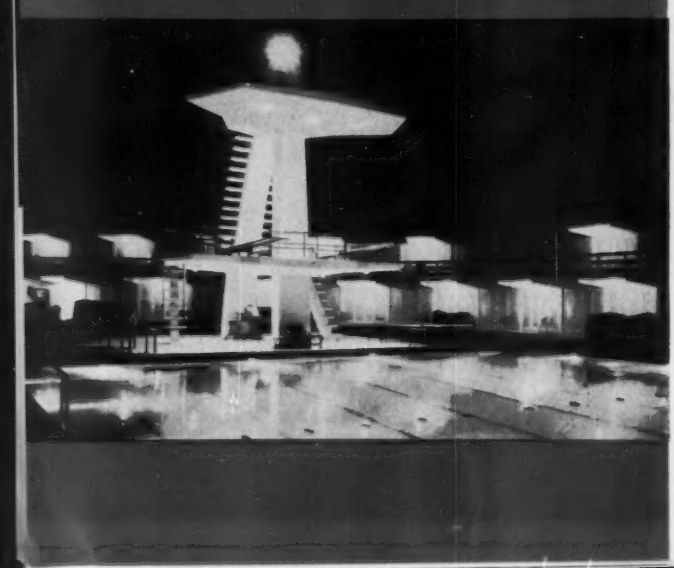
Sources: National Petroleum News and Westinghouse Electric Corp

MARKET: 1957-1966

According to McGraw-Hill's 1957 National Petroleum News Factbook, the number of service stations in the U. S. will go from 182,790 in 1957 to 185,947 in 1966. This is an increase of only 1.7%, and appears to be almost linear. EAR and kwhr for any year(s) in the 10-yr period may be obtained by extrapolation.

•

Figures at left are based on a typical service station driveway: 100 x 130 ft, with three pole locations, using hinged poles and remote ballasts.



Recreation Lighting: Sell It by 'Town-ful'

Outdoor sports and recreation have created a market in which lighting can be sold by the "town-ful".

In the sandlot behind the little red schoolhouse and in the big city stadium, in the parks, playgrounds, swimming pools, golf courses, and roadside amusement parks, outdoor lighting can be sold and sold profitably.

Probably the best way to sell outdoor recreational and sports lighting is by the "town-ful," that is, to sell it to the community. The community's interest in it is much the same as it is in good street and highway lighting. Lighting local athletic fields, parks, and swimming pools stimulates interest in nighttime sports. This has proved to be an important factor in reducing juvenile delinquency and traffic accidents. Civic pride and prestige are also involved.

Utilities will have to work with town boards, planning commissions, citizens' committees, and others to reach the publicly-owned recreational facilities. Properly done, such cooperation will produce many benefits other than increased lighting load. Good public relations is the principle one.

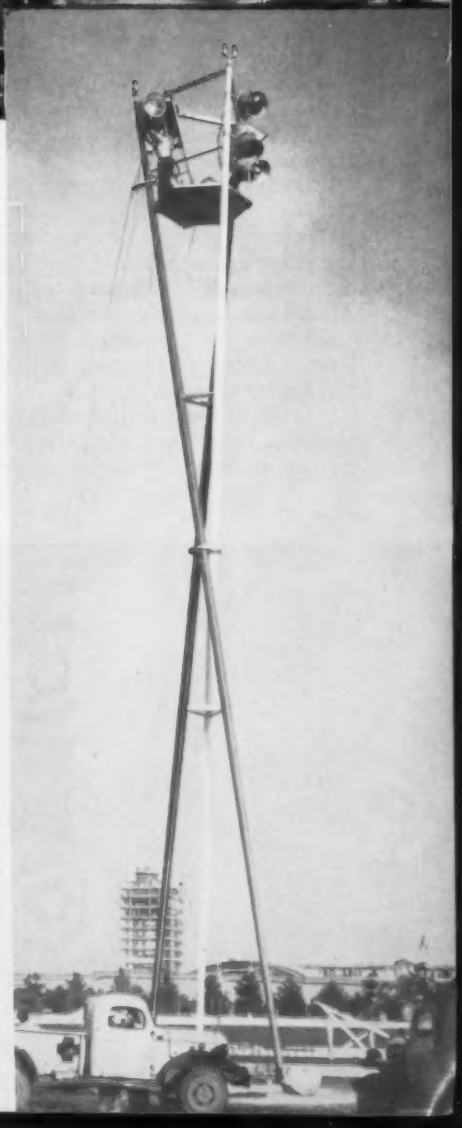
Schools Are Biggest Market

Schools present the greatest market for outdoor recreation lighting. According to the latest published statistics of the Department of Health, Education, and Welfare, there are 137,000 elementary and secondary schools in the United States. In the years 1953-54 (the years covered by the department's survey), these schools spent more than $900 million on plant operation and maintenance and an additional $58 million for health and recreational services. Further breakdown of these figures was not available; therefore, the amount spent for lighting is not known. However, if 1 kw in schoolyard lighting had been installed in each of these, it would add an estimated $1.3 million in annual revenue.

Don't overlook the ball parks and race tracks. True, all the major league ones are lighted, but there's a string of smaller, minor league parks that are potential customers for night lighting. Selling point here is that these can be used at night for activities other than baseball, increasing gate receipts. Metropolitan Sports Area Stadium in Minneapolis is a good case in point. Put up recently by the City of Minneapolis and surrounding communities with an eye to a major league franchise, it is considered by many to be the country's best lighted minor league park. Average illumination is 83-ft-c in the infield and 58 in the outfield.

Swimming pools, also, present interesting possibilities. Underwater illumination for nighttime swimming is also on the upswing.

The market for recreational lighting may not be so well defined as we'd like, but it is definitely there. Utilities, if they want it, will have to go out and get it.



Idlewild 'Daylight' Never Ends

What is probably the world's largest installation of blanket floodlighting is now being completed at New York's International Airport (Idlewild).

"Terminal City," as the project is known, comprises a 665-acre area that will have "never-ending daylight." Some 43 towers or pylons (see illustrations) will support 338 specially designed 1,500-w mercury quartz lamps to light 6 million sq ft of area at levels of 1.5 to 8 ft-cs. These lamps, rated at 81,000 lumens, are arranged in clusters of six, eight, ten and 12 on the pylons. The pylons are 75 ft high and spaced 320 ft apart. Connected load, according to Port of New York Authority, which operates the airport, is 585 kva.

A general blanket-type illumination was decided on for a number of reasons. The airport handles some 3,300 flights and 150,000 passengers a month, plus thousands of visitors. Terminal City will contain ticket offices, restaurants, a hotel, retail shops, parking areas, and a botanical garden. Lighting is the logical answer to (1) attract attention at night to these activities; and (2) give a unifying effect to the entire project. The area, lighted to various levels, was designed to present a striking appearance from the air as well as from the ground. It is believed to be the first time this was done.

Terminal City will have its colored fountain, too. A 40-ft center jet with a 75-ft dia curtain, formed by 852 jets, will be lighted in blue, orange, and violet. Special 300-w underwater lamps are being used.

Engineers estimate that, were conventional methods used to light the terminal's areas, about three times as many floodlights and 12 times as many standards would have been necessary.

Terminal City is an up-to-the-minute illustration of the new and dramatic ways in which outdoor lighting is being used to change the country's face.

Industrial Lighting:

Here's Where You Find the Big Ones

Industrial outdoor lighting is the "Big Bertha" of the industry. Basically, it falls into two groups.

- Outdoor plant lighting for security and safety.
- Outdoor lighting for advertising, recognition, or decorative effects.

Of the two, the first is by far the largest market. According to one manufacturer's spokesman, companies owning and operating large factories are realizing that outdoor lighting helps them up the "return on investment." Or, as another lighting equipment maker puts it, "Protective lighting is productive lighting."

Protective lighting, though, has some unique problems. These must be recognized by the utility's industrial lighting salesman:

- Protective lighting must function from dusk until dawn every night. Reliability, therefore, is of prime importance.
- A single flaw in an outdoor protective lighting layout can render the system worthless.
- System should operate independently of lights used for production.
- Equipment must withstand effects of weather.
- It must be served by a reliable source of power.

These five points cover the nature of the equipment and power source in a protective lighting system. There are also several basic principles concerning its function. An outdoor lighting system must—

- Discourage attempts at entry. Make the outdoor lighting scheme so complete that the would-be intruder will not try to get in.
- Make detection certain when someone does attempt to enter. Light boundaries, approach and interior areas so that guards will be able to spot the attempted entry.
- Aid the guard and hinder the intruder. Locate lights so intruder must face glare, and the guard can be hidden behind it.
- Eliminate objectionable glare. Lighting must be such that it illuminates the desired areas but doesn't interfere with traffic or activities on adjacent property.

Work areas present other good possibilities for industrial outdoor lighting. Loading docks, wharves, material storage areas, railroad yards and sidings, and other work areas require lighting for safety and efficiency. Most have it but generally it is inadequate by present-day standards.

Factory owners, like their commercial counterparts, have to be sold on what outdoor lighting can do for them. The problem is somewhat different, however. The commercial customer is using lighting to attract customers, whereas the industrial one needs it to improve his plant-operations. He has to be shown how lighting will help accomplish this.

Demonstrations seem to be the logical answer. The actual techniques may offer some difficulty. For one thing, an improvement in an industrial operation ordinarily takes more time to show up than does, say, an increase in retail business. Power companies must work out suitable demonstration techniques.

Much industrial outdoor lighting went on utility lines during the war, and is now dated and obsolete. New equipment, improved fluorescent and mercury sources point the way to higher and more adequate ft-candle levels without too great an increase in cost—always an important consideration.

Changes in industrial plant design have created new trends in outdoor lighting.

INDOOR LIGHTING FOR OUTDOOR EFFECT is a technique being used among newer industrial plants. Ceiling lighting in peripheral areas is designed to coordinate with outdoor lighting indentification and for advertising value

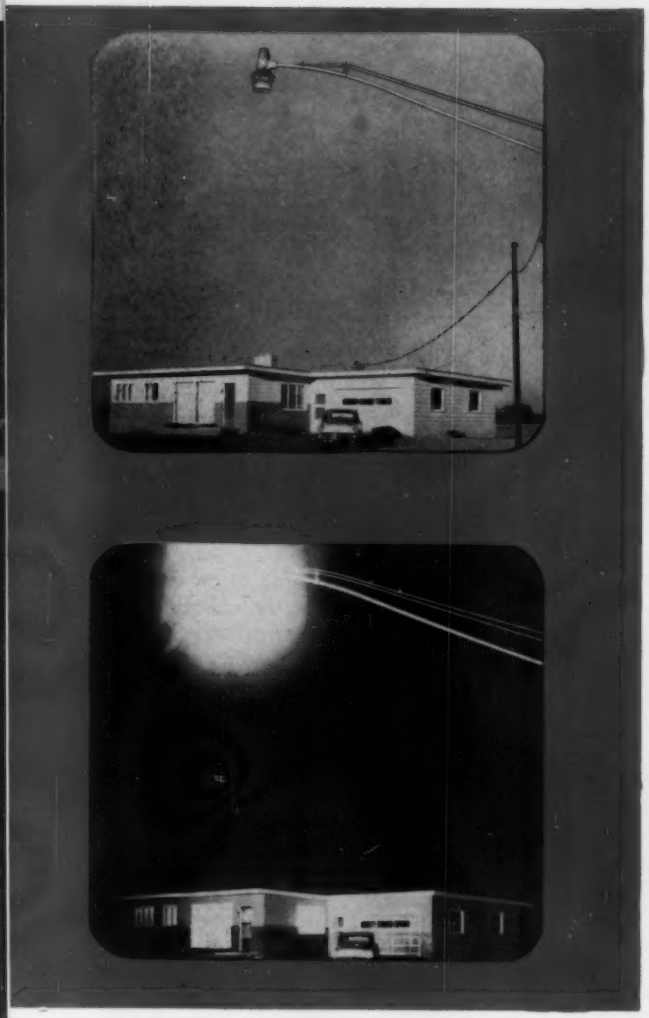
These design changes are a result of the tendency on the part of industrial concerns to decentralize. Plants are moved to areas lying outside the usual industrial zones or suburban ones. Appearance and recognition become important. The result is a long, low one-story plant, usually fronted with office space, attractively faced and landscaped. As in the case of residential architecture, the trend is to blend the building with its surroundings. An attempt is made to integrate both inside and outside, and outdoor lighting becomes part of the original planning.

Power companies have the same advantage here they have with shopping centers. They know in advance that a plant is in the offing because they will be called upon to provide service.

Industry today is more public-relations conscious than ever. Stress, therefore, that proper outdoor lighting can be instrumental in promoting acceptance of the factory as a "good neighbor" and one that will not devalue surrounding property and turn the neighborhood into an industrial slum.

Any promotion aimed at upping industrial use in other than the newest plants will probably run into a problem set down by Edwin Vennard, managing director of EEI, at its sales conference last spring. This is the matter of inadequate distribution systems within the plant themselves. Said Vennard, ". . . Kilowatthours are replacing man-hours in production at an unprecedented rate. As this trend develops, we find more and more plant distribution systems reaching the limit of their capacity. This is particularly true of the smaller plants. It presents a very definite and limiting road block which has been recently recognized by the Industrial Electrification Council." Utilities planning aggressive industrial lighting programs will have to take the lead in getting around this block. Mass selling techniques in the industrial field are just beginning to be recognized. One utility has recently begun a course in industrial lighting, aimed at improving plant lighting. Reaction has been very favorable.

Industrial outdoor lighting—for plant security, safety, or appearance—is a good off-peak load. Our expanding economy means larger, more automated plants that demand an ever-growing kwhr capacity. Lighting holds great promise both as an industrial load builder and as a balancer. But it must be sold.



Sell the Lighting— But Keep the Lights

Here's a unique outdoor lighting scheme used to sell kwhrs by power companies in Ohio:

The power supplier buys an outdoor light, installs it, supplies the power, and gets a nominal monthly charge for it. The plan is used on rural homes, farms, small industrial plants, and other places where there is no street lighting. It allows the customer, who wants and needs outdoor lighting for security reasons, to have it without the equipment investment and maintenance that otherwise might stop him.

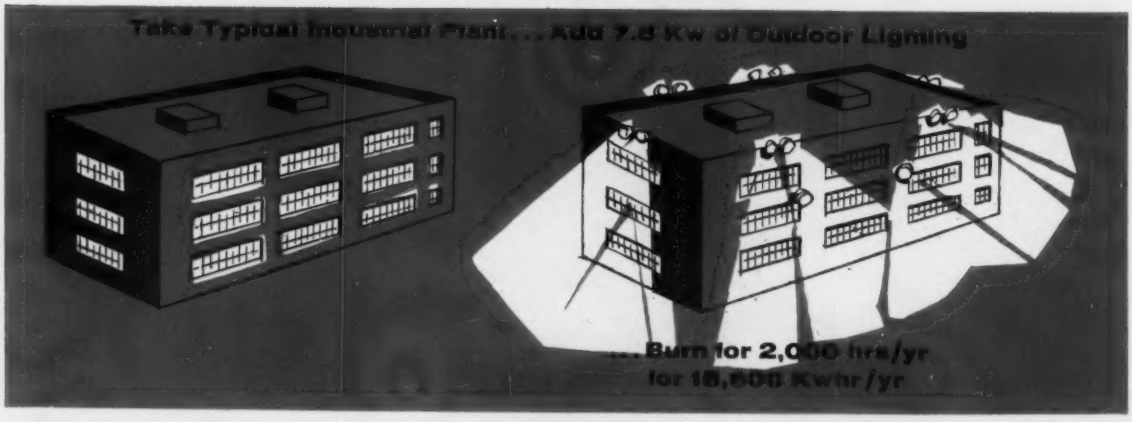
Location is governed by the user's needs. Individual control is provided by an photoelectric cell mounted atop the luminaire.

Power companies and co-ops sell the lighting by stressing its benefits:

- Increased protection from prowlers, animals, etc.
- Better road and driving safety.
- Greater ease in doing chores after darkness.
- Prestige value—home looks nicer lighted.
- Lighting for outdoor activities, such as barbeques and lawn games.

The utility stands to gain also. The lights have a good load factor; they're used mostly off-peak. They provide an automatic visual signal to lineman during nighttime outages because they indicate line sections that are energized. (This is important in areas not heavily populated.) And their public relations value has been good. Some power companies trace a willingness of people to build in rural areas to them. Previously, lack of good street and highway lighting was a deterrant to such moves.

Recipe for Boosting Industrial Lighting Load



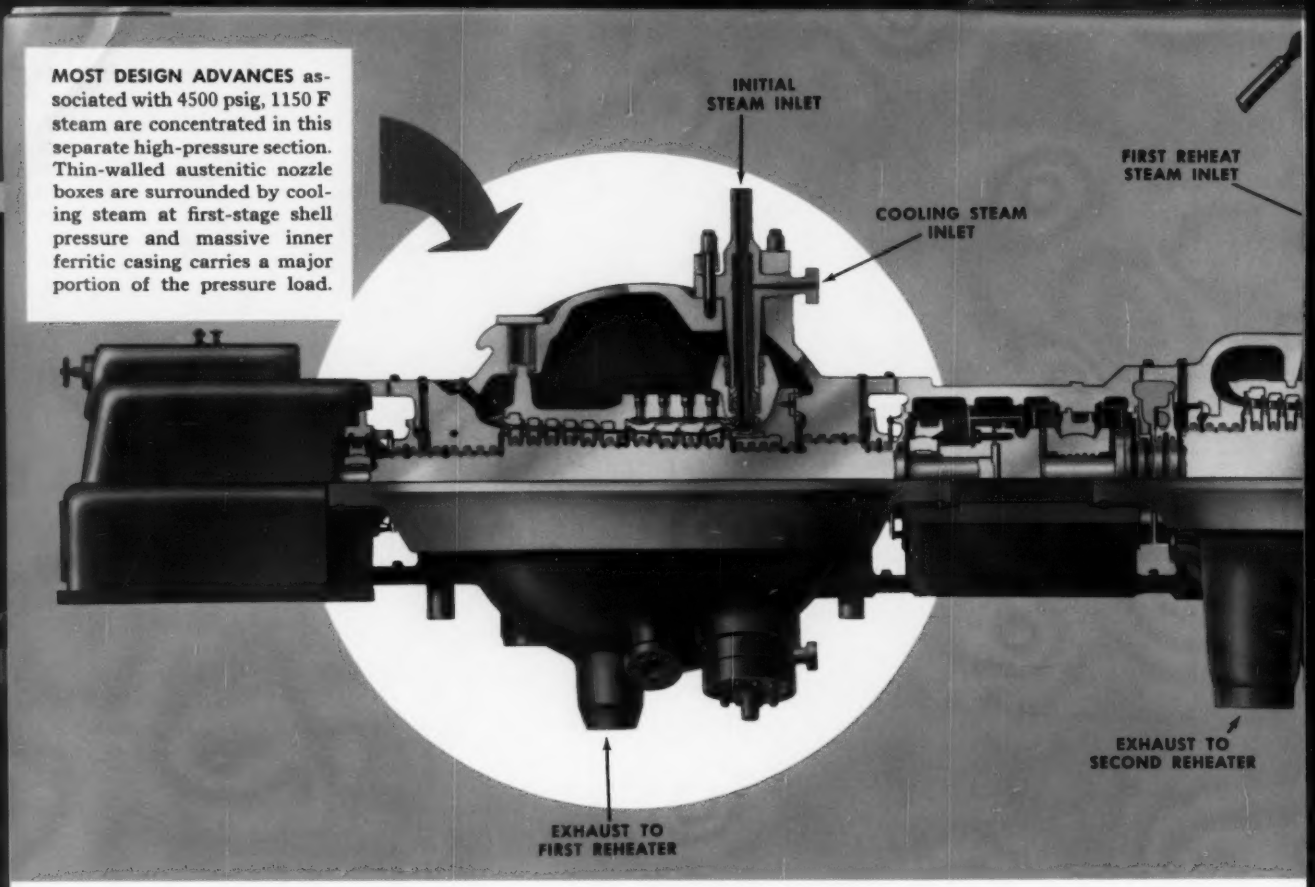
World's First Supercritical Double-Reheat Steam Turbine Installed at Philo Plant

New 125,000-kw General Electric unit at Philo Plant of Ohio Power Company marks another milestone of progress in the development of more economical electric power production through higher initial steam conditions.

Progress Is Our Most Important Product

GENERAL ELECTRIC

FOR DETAILS, TURN TO NEXT THREE PAGES


MOST DESIGN ADVANCES associated with 4500 psig, 1150 F steam are concentrated in this separate high-pressure section. Thin-walled austenitic nozzle boxes are surrounded by cooling steam at first-stage shell pressure and massive inner ferritic casing carries a major portion of the pressure load.
INITIAL STEAM INLET
FIRST REHEAT STEAM INLET
COOLING STEAM INLET
EXHAUST TO SECOND REHEATER
EXHAUST TO FIRST REHEATER

Higher pressures and temperatures operate through double-reheat cycle to raise fuel economy

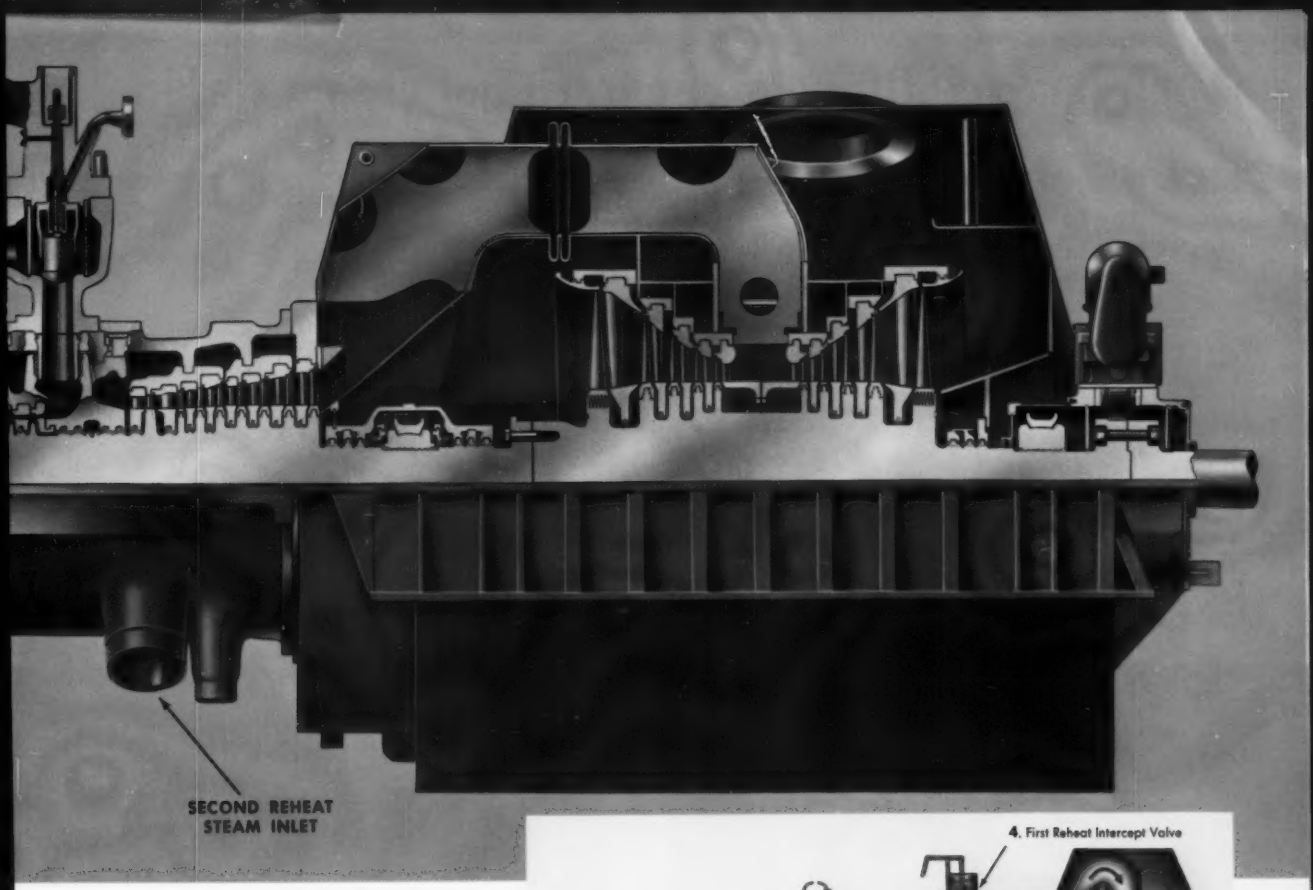
New unit will run at 4500 psig, 1150 F initial temperature, with 1050 F first reheat and 1000 F second reheat

The Ohio Power Company's Philo Plant, one of the key generating units of the American Gas & Electric Company's system, has become the site of another significant advance in electric power generation. It will be the first station to generate commercial electric power from a turbine-generator operating at the supercritical pressure of 4500 psig—almost double the highest pressure used to date. Its initial steam temperature of 1150 F is 50° greater than the previous high of 1100 F reached only three years ago.

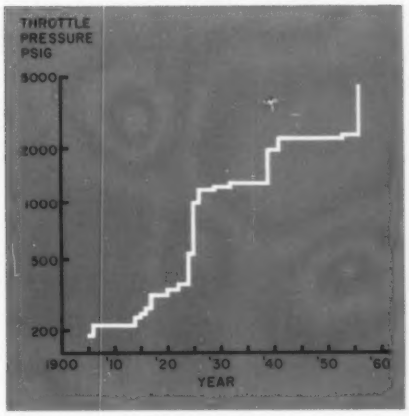
These advanced steam conditions, coupled with the first application of the double reheat cycle, can increase thermal efficiency 5% over the most efficient steam plant now in operation.

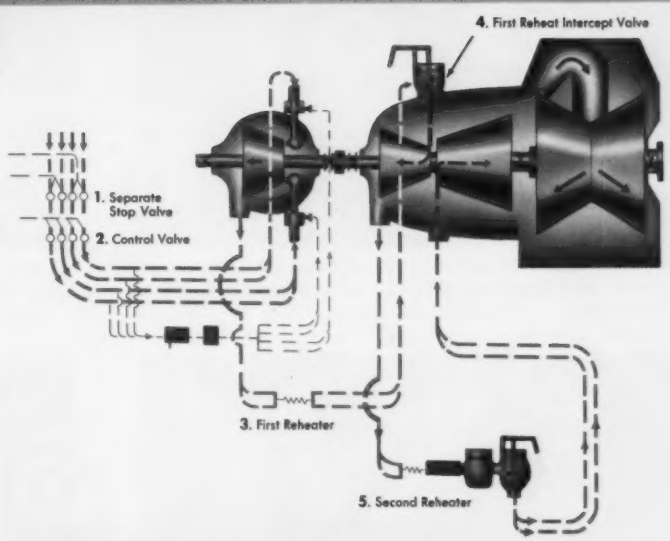
ONE OF THE MAJOR PROBLEMS General Electric designers had to overcome was the danger of thermal distortion of thick austenitic castings and forgings. So austenitic steel parts were made as thin as possible by use of 1) a steam cooling arrangement which permits the use of thin-walled austenitic sections with low temperature gradients and reduced susceptibility to distortion, 2) individual control valve bodies of small diameter and consequently thinner walls, 3) multiple steam pipes with individual turbine stop valves placed in each line, and 4) simple throttling control with full 360-degree arc admission to the first stage nozzles.

THE EXPERIENCE GAINED and new ideas developed during the design and manufacture of this first supercritical-pressure steam turbine are already being applied to the study of larger units for even more economical operation. The Philo turbine may well mark a turning point in the history of steam power generation. For more details, write for Bulletin GER-1130, Large Steam Turbine-Generator Department, General Electric Co., Schenectady 5, New York.



Progress in increasing throttle steam pressure over the past 50 years. The new advance to 4500 psig represents the first major step upwards since a maximum of 2300 psig was achieved in the early 1940's.





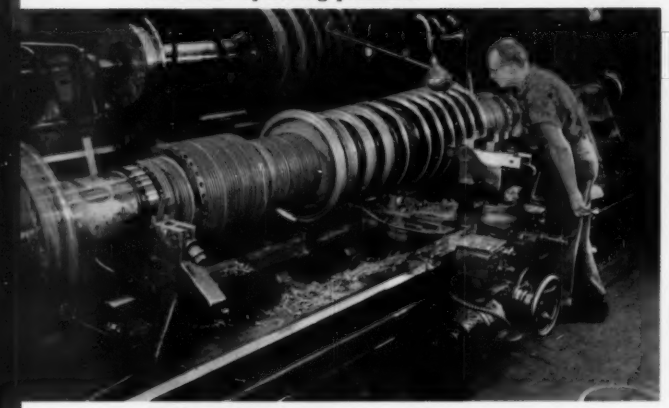
SUPERCRITICAL STEAM ENTERS THE TURBINE through four main steam pipes. Each pipe has a separate stop valve (**1**) and control valve (**2**) located below the turbine room floor. Steam exhausts at 800 F to first reheater (**3**). Here it is reheated to 1050 F and enters center of intermediate turbine through first intercept reheat valve (**4**). Then it expands through nine stages toward middle standard and exhausts to second reheater (**5**) at approximately 207 psig, 600 F. Steam leaves reheater at 1000 F to re-enter remaining portion of intermediate section, passes through crossover, and expands to condenser through double-flow, low pressure turbine.

GENERAL ELECTRIC

Building a 4500 psig supercritical steam turbine...

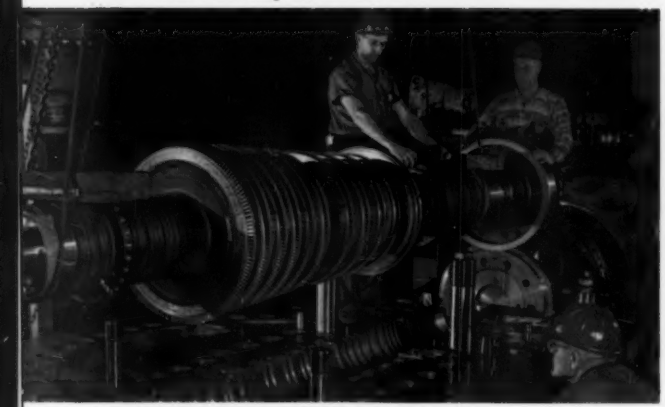
1 **CASTING COMES IN:** Lower half of massive cast ferritic outer casing for high-pressure section is delivered. Spherical shape helps minimize stress and enables casing to withstand operating pressures.

2 **MACHINING OF CASTING** is done with extreme accuracy. Prior to machining, casting was thoroughly checked for internal flaws by 15-million-volt betatron, which can "see" through more than a foot of steel.



3 **ROTOR IS MACHINED** from a solid forging of Type 347 steel, then heat treated to remove stresses. An alternate steam-cooled ferritic rotor is also being supplied for further developmental studies.

4 **ROTOR IS INSPECTED** after final assembly. First stage buckets are only about $\frac{3}{8}$ in. long, with multiple-hook dovetails designed to take care of differences in thermal expansion between rotor and buckets.

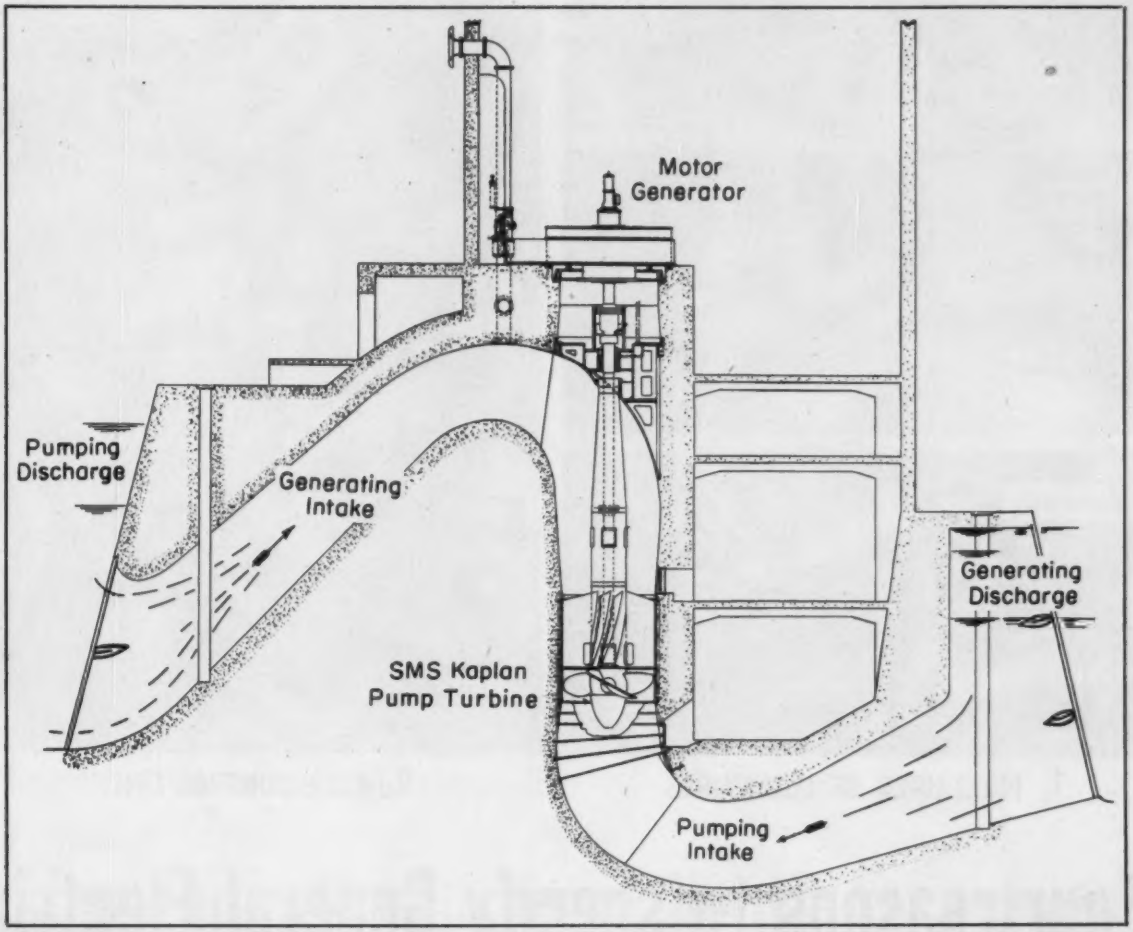


5 **TURBINE IS ASSEMBLED** as high-pressure rotor is lowered into lower half of shell. High temperatures and pressures necessitated several unique innovations in design of diaphragms and other parts.

6 **FINAL ASSEMBLY** is culmination of months of designing, manufacture and exhaustive testing of individual components. Operating at 4500 psig, this unit will help evaluate the use of supercritical steam. 254-32

Leader in Turbine-Generator Progress

GENERAL ELECTRIC



CROSS-SECTION of pump-turbine unit for Traicao pumping plant near Sao Paulo indicates two major functions. Two identical units are already in operation there, pumping water to Billings Reservoir for Cubatao power plant use

TODAY'S DESIGN TREND

Pump-Turbine Applications Are Many

An adjustable-blade, axial-flow, reversible pump-turbine, ordered by Canadian-Brazilian Services Ltd., for Sao Paulo Light S.A.—Servicos de Eletricidad, exemplifies the applications possible with the Smith-Kaplan pump-turbine.

The unit which will be installed in a vertical setting in the Traicao pumping plant near Sao Paulo, Brazil, will supplement two older pump-turbine units furnished the same customer by the same firm. The first of these, manufactured in 1938, was the first reversible pump-turbine installed in the Western Hemisphere. The design of these units was perfected on the pump-turbine testing stand in the S. Morgan Smith Co's hydraulic laboratory at York, Pa.

Has 138-in. Diameter

The Traicao pumping plant, on the Pinheiros Canal, is one of a series of low-head pumping plants connecting the Tiete River with Billings Reservoir. The reservoir supplies water to the high-head Cubatao power plant at the base of the coastal cliffs near the Brazilian city of Santos.

The new unit measures 138 in. in dia. Directly connected to a 6,600-hp motor, it will operate under a net head of 10 to 23 ft. It is guaranteed to pump 1,765 cfs under a 23-ft head at 150 rpm and to generate 3,450 hp under the same head.

When water is low in the Tiete River tributaries, water released from Billings Reservoir for irrigation and general municipal purposes will drive the unit as a turbine and generate power. When the unit is not required as either a pump or a

(*Continued on page* 110)

1. FULL LINES OF LUMINAIRES

2. FULL CONTROL LINE

Four reasons to specify General Electric

When you place your street lighting business with General Electric, you buy more than quality products alone. You get a complete package of products AND service backed by engineering skills and research findings. You get benefits which have come about through years of experience in serving the public lighting needs of the nation.

Specifically, here's what you can draw on when you work with General Electric in developing a ***vision-engineered system*** for best lighting of your streets:

1. FULL LINES OF LUMINAIRES

Whatever the application—whiteway, main street, primary or secondary traffic artery, residential street, highway, bridge, viaduct, underpass—you can choose from ***all three*** light source types: filament, mercury, and fluorescent. Only General Electric offers you full lines of all three!

Since G.E. offers complete selection, you know we have no "axe to grind" in recommending one luminaire type over another. The advice you get will be impartially based on the engineering and economic facts for your particular situation.

2. FULL CONTROL LINE

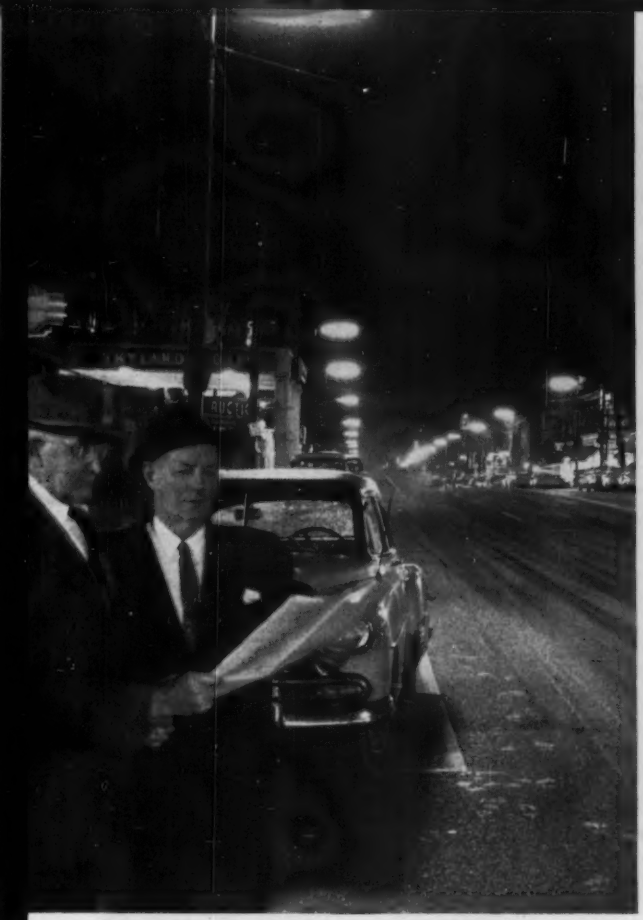
General Electric's full line of circuit equipment will integrate your street lighting into a dependable, efficient system, no matter what the situation may be!

For every combination of factors affecting control and protection—type of light source used, circuitry, wiring, etc.—a different solution is required. Experienced General Electric lighting specialists will utilize proved equipment to develop a control system exactly suited to your needs.

3. START-TO-FINISH APPLICATION HELP

Initial survey, preliminary application investigation, action recommendation, complete Illuminating Engineering Report for your staff or consultants . . . these services are included in the application aid "package" at your disposal when you place your street lighting business with General Electric!

Experienced General Electric outdoor lighting specialists are located in every major city. Backing these field specialists are more career lighting men at the Hendersonville, N. C., plant. The talents of both groups are available to you at all times.



3. START-TO-FINISH APPLICATION HELP

4. RESEARCH LEADERSHIP

vision-engineered street lighting systems

Benefit from the years of street lighting experience General Electric has gained since Thomas Edison lighted the street in front of his home in 1879! Put this know-how to work devising the best means to bring greater visibility to your city's streets!

4. RESEARCH LEADERSHIP

At General Electric's "Outdoor Lighting Center of the World" in Hendersonville are located the industry's newest and most complete laboratory, development, and proving facilities.

These facilities are being used on present, as well as future, problems. For example, a fully equipped photometric laboratory assures you precise accuracy of light output measurements and distribution curves for all types of equipment. Another example: four full-sized demonstration streets provide an authentic means for application experiments involving many different street lighting variables.

Moreover, special tests are run for customers, at their request, by a trained, professional engineering staff wholly devoted to ever-greater advances in the art and science of public lighting.

INVESTIGATE NOW!

Let your Apparatus Sales representative or authorized agent help you get the optimum amount of *vision* from an integrated *system* which is *engineered* to your particular street lighting situation! General Electric Co., Schenectady, N. Y.

452-172

LIVE BETTER ELECTRICALLY

VISION-ENGINEERED STREET LIGHTING SYSTEMS

GENERAL ELECTRIC

Applications Many

(*Continued from page* 107)

turbine, water can be depressed from the runner passages with compressed air to permit operation as a synchronous condenser to improve system power factor.

Smith-Kaplan pump-turbines may be used to pump water into storage reservoirs during off-peak hours. This water can be released to operate the unit in the reverse direction as a turbine when system loads are at maximum.

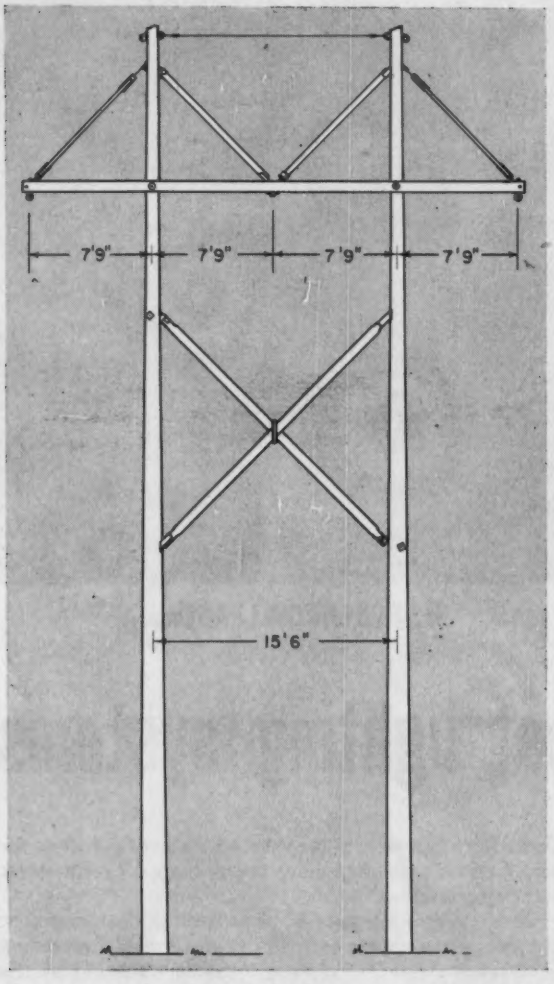


Fig 1. CROSSARM BRACES in tension will be feature of construction of 138-kv, H-frame line built by Dayton P&L

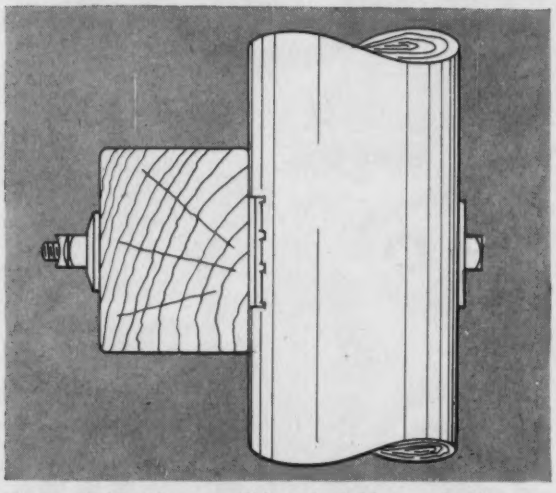


Fig 2. ENDS of braces will be adjustable to pole diameters

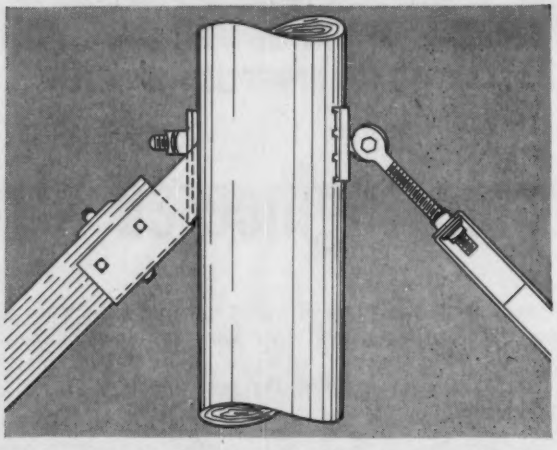


Fig 3. CROSSARMS WILL BE ATTACHED to poles with shear plates that have spikes for gripping the wood of the pole

Crossarm Braces Adjustable for Length

Dayton Power & Light Co is drawing up plans for a 138 kv-line using H-frame construction with crossarm braces in tension. Ends of the two outside crossarm braces are adjustable for length.

This accommodating feature permits positioning on the side of the pole for development of maximum strength and adjustment of the brace length to fit with various pole diameters. At the pole attachment of these braces there will be a malleable iron shear plate, curved to fit the pole circumference and spiked to grip the wood.

Malleable iron spiked grid connectors will make the attachment of the crossarm to the pole. One side of the grid connector will be curved to fit the pole; the other will be flat to fit the arm. Spikes will grip the wood.

Single-arm construction is planned for the 138-kv line.

(*More How To on page* 112)

Lighting Standards and Sign Spans by P & K blend into that pleasant "Florida Look" on the Sunshine State Parkway

An outstanding example of distinctive design and far-sighted planning, the Sunshine State Parkway may well be a model for many future traffic arteries.

From start to finish, the accent was on beauty, safety and economy, generously sprinkled with welcomed originality.

Naturally, modern thinking demanded modern materials. Clean, bright, lightweight and strong P & K aluminum products were specified and installed wherever possible... from lighting standards to over-the-road sign spans. No rust, no painting, high resistance to corrosion... and no maintenance, despite the characteristic sea air of healthful Florida.

Write for the latest P & K catalogs on highway lighting and traffic control products... and use the P & K planning and advisory services without obligation.

P&K PFAFF & KENDALL
84 Foundry St., Newark 5, New Jersey

P & K SEAMLESS TAPERED ALUMINUM LIGHTING STANDARDS ARE INSTALLED AT ALL INTERCHANGES AND SERVICE AREAS. P & K SIGN SPANS HELP GUIDE MOTORISTS ALONG ENTIRE PARKWAY.

DISTRIBUTION—Maintenance

New Transformer Records Save Clerical Time

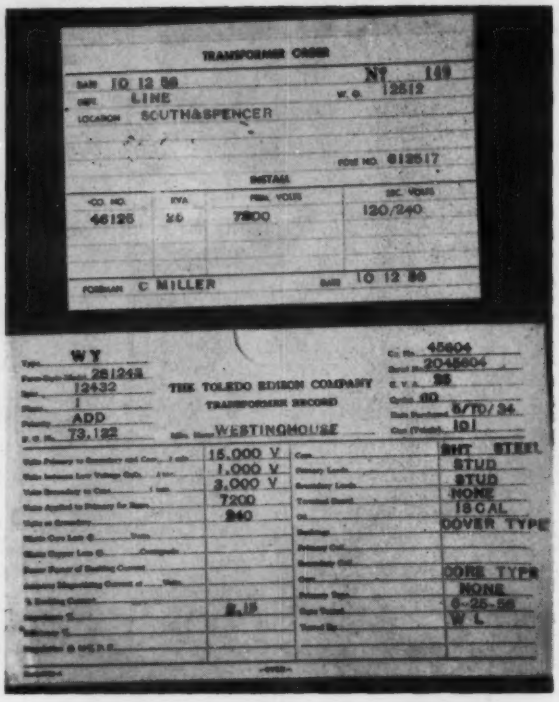
GEORGE ROBERTS, Superintendent, Transformer Dept., Toledo Edison Co, Toledo, Ohio

Toledo Edison Co uses a combination envelope and flat card in setting up a distribution transformer location and statistical record. This record system cuts down much clerical work.

Formerly the location of the transformer was transcribed in long hand by a clerk from a work order to the back of a transformer card. This card carried the statistical record. With the transformer traffic as it is today, considerable time would be required to keep such records up to date.

For the new record procedure, an envelope has been designed to represent a single transformer throughout the transformer's life. The location is recorded by inserting a copy of the transformer work order into the envelope.

The new system provides the same information as the older system with a savings in clerical time.



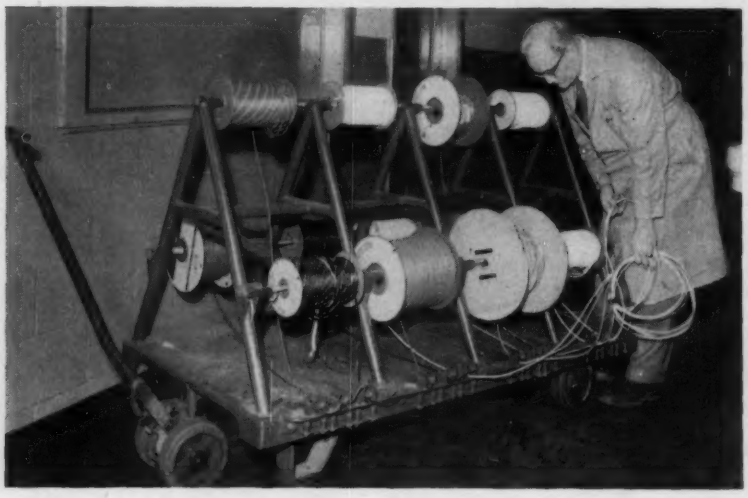
GENERATION—Maintenance

Eases Oil Transfer

A portable fluid transfer tank has eased maintenance jobs for crews at Southeastern Public Service Co's Plant X. The tank transfers 140 gal of oil by means of a ¼-hp pump mounted on the side.

The tank and its three-wheeled dolly were built from scrap materials by plant personnel. A self-priming, flexible-impeller paddle pump, a cotton-pad filter pack, piping, and valving complete the installation. The fluid coupling can be drained and the oil transferred to the centrifuge in 55 min, without moving the heavy centrifuge. Crews use the transfer tank also for draining oil from bearing supply headers, turbine front-end standards and cooling tower fan gearboxes.

METERING—Construction



Truck Speeds Wire Dispensing

RICHARD H. GABRILE, Meter Department, Detroit Edison Co, Detroit, Mich.

A wire storage and dispensing truck facilitates operations in Detroit Edison's meter department. It has a capacity of 12 reels of wire and can be rolled anywhere for dispensing wire.

The wire truck handles reels 8 to 24 in. in dia and up to 18 in. wide. Reels are replaced by lifting the bearing bar from the cradled slot. Tension rollers permit different wire sizes to be pulled.

FULL STEAM AHEAD-

AT UTAH
POWER & LIGHT CO.

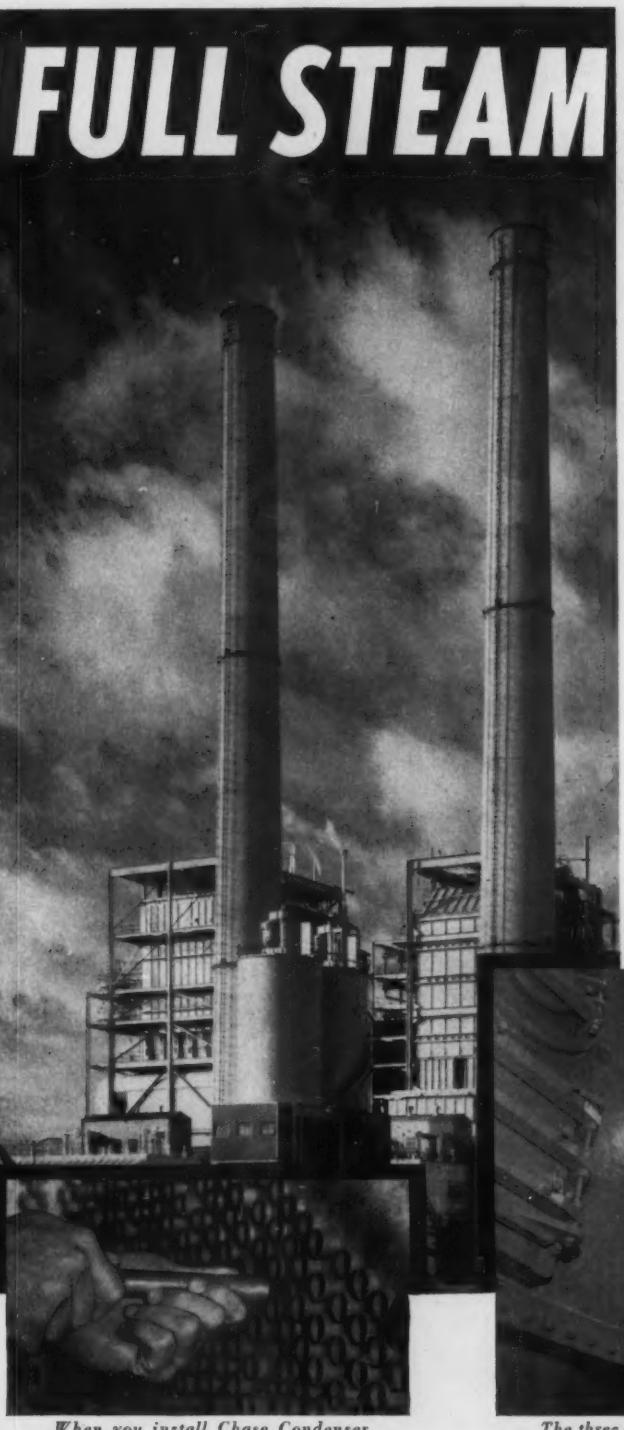
with Chase® Condenser Tube!

It's a big job keeping up with the light and power needs of the Intermountain area! Demand has more than doubled in the last 15 years...keeps growing all the time.

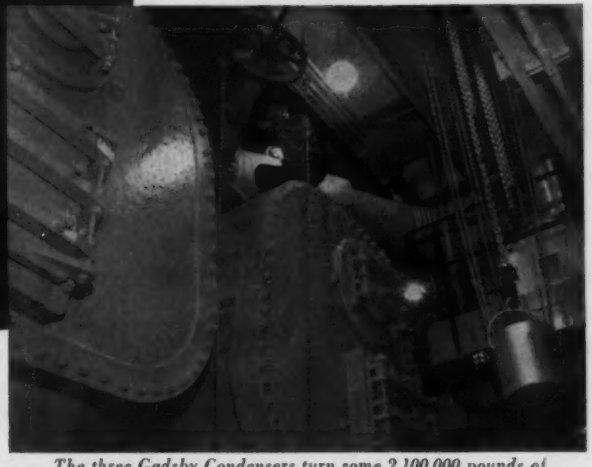
But at its Gadsby Steam Electric Plant in Salt Lake City alone, Utah Power & Light Co. has 20,396 "helpers" to depend upon. That's how many Chase Antimonial Admiralty Tubes keep three giant condenser units humming all the time.

No power failure due to tube failure here. Just the right amount of antimony guards Chase tube from de-zincification. And Chase quality control assures long, trouble-free tube life.

Shouldn't *you* be using Chase Antimonial Admiralty, too?



When you install Chase Condenser Tube, count on years of service ahead!



The three Gadsby Condensers turn some 2,100,000 pounds of steam back to water every hour at full plant load of 241,000 kw.

Chase

BRASS & COPPER CO.
WATERBURY 20, CONNECTICUT
SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass, Copper and Stainless Steel

Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York (Maspeth, L. I.) Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

Florida Power Spots Lighting Among 3R's

Utility finds students, teachers, parents eager for more educational lighting information

"Light for Living" has gone to school in Florida. An extensive campaign to bring the program to students and adults was started by Florida Power Corp last year. Since its inception, almost 80,000 people have been exposed to the hour-long lighting education.

W. H. Wilfong, an FPC lighting specialist, has been the driving force behind the show. Wilfong had been giving lighting lectures to home economics classes in local schools. He reasoned that a program presented at school assemblies, where he could reach teachers and principals as well as students, would be a lot more effective.

To find out whether the idea would be feasible, Wilfong called on all elementary, junior high school, and senior high school principals in St. Petersburg. He got an enthusiastic reception, and Florida Power went ahead and instructed its other sales people to "go now and do likewise."

When all schools had been lined up, Wilfong began his tour. His program is built around the following:

- A 10-min. talk on the history of light.
- A lighting story film. One of three films was used, depending on the students' age and grade level. Films are "Bright Future," "Reddy Made Magic," and "Light Is What You Make It."
- A talk on bulb development (13 min.). This was illustrated by using a display board having eight bulbs from the early clear lamp to the inside-frost, silica-coated white and coloramic bulbs.
- A 5-min explanation of proper lighting for watching television.
- A 3-min discussion of the Recipe Lighting Booklet, 50 copies of which were left in the school library.

LIGHTING LECTURES, like this one, have reached some 80,000 students and adults in Florida Power Corp's area

What were the totals? Some 342 programs reached almost 75,000 students and 3,000 teachers and principals. Two colleges were included in the program.

As a result of these programs, Wilfong was invited by and spoke to 30 service-organization groups.

All programs were well received. Many requests have been received for lighting programs of an educational nature. "Light for Living" in schools is another example of FPC's long-range promotion activities.

Color Lighting Boosts Auto Sales

DONALD C. STATHAM, Commercial-Industrial Sales Engineer, Pacific Power & Light Co, Coos Bay, Ore.

Matching the color of light to the color of the car is the outstanding feature of an auto showroom lighting system in Coos Bay, Ore. The system was designed by the author for Young's Pontiac, a promotion-minded dealer there. Colored lamps put red light on a red car, green light on a green car, etc. "My well-illuminated showroom," says owner Wave Young, "is my best salesman."

General lighting of 100-ft-c level in the glass-fronted showroom is by recessed fixtures, using cool-white fluorescent lamps. The feature car in the center of the floor is lighted by flush incandescent fixtures, using 300-w lamps.

Showroom ceiling is a pastel yellow. Walls are light green texturized plywood, and floors are of light asphalt tile. Combination has both eye-pleasing quality and good reflectance. Two 10-kw blower unit heaters keep condensation off windows. Each private office is equipped with recessed vinyl pan fixtures, and has same color scheme as showroom. Both parts room and service shop are lighted to high levels, with schemes designed for good reflectance.

The unique matching-the-color-to-the-car idea has proven to be a good eye catcher. It is illustrative of the ways in which a good commercial lighting job can be sold: by showing the customer what it can do for his business.

Floodlight Grand Coulee

The Federal Government has authorized the lighting of Grand Coulee Dam. The lighting installation, which will produce an effect "nothing short of spectacular," will use approximately 750 wide-beam, 1,500-w floodlights. Focal point of the lighting will be the central spillway over the falls. General Electric Co has the order.

(*More Selling on page* 123)

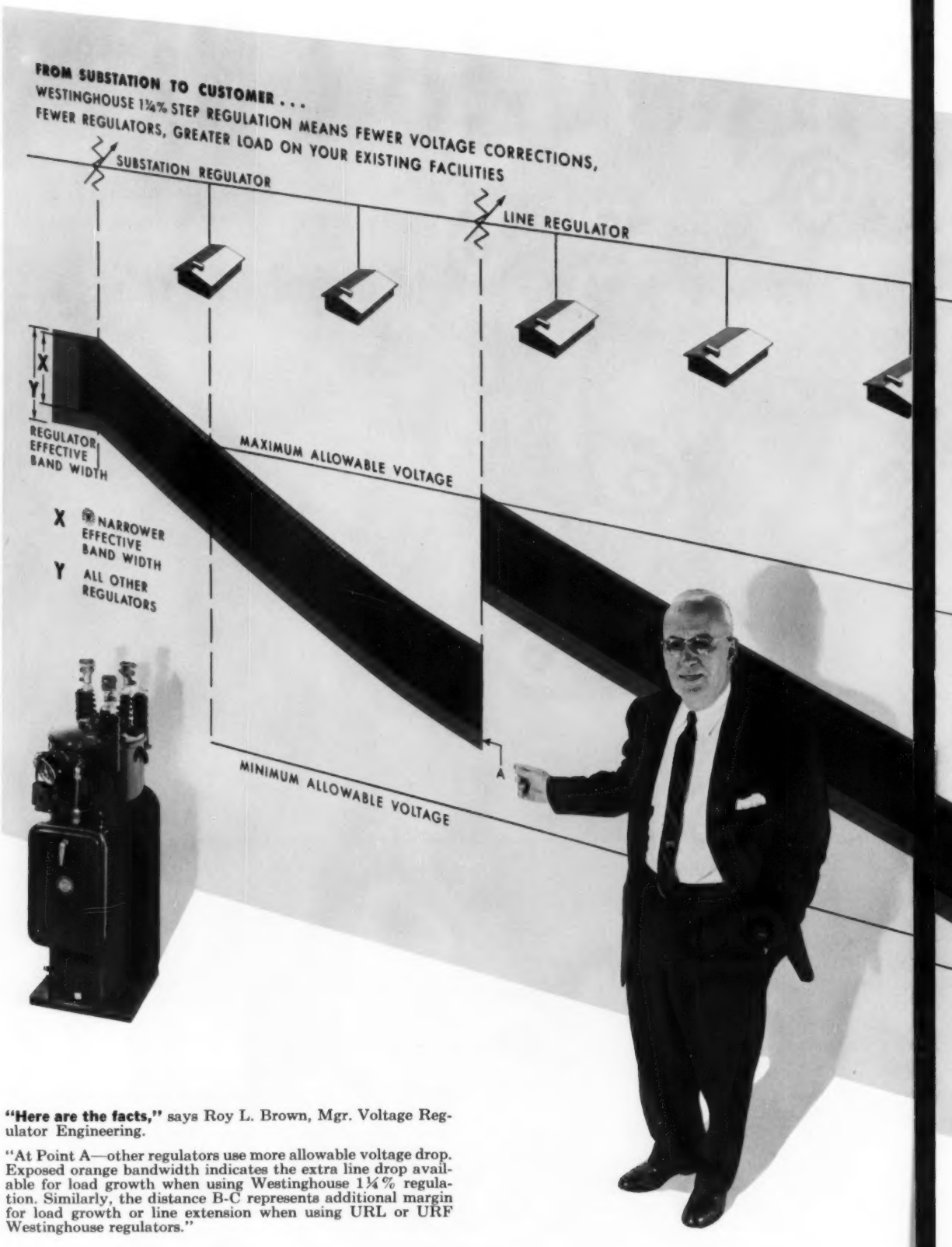
REGULATOR NEWS

Westinghouse extends advantages of 1¼% step regulation to higher kva ratings

Left—URF regulator extends range of 1¼% step regulation . . . reduces your initial investment for regulators up to 167 kva.

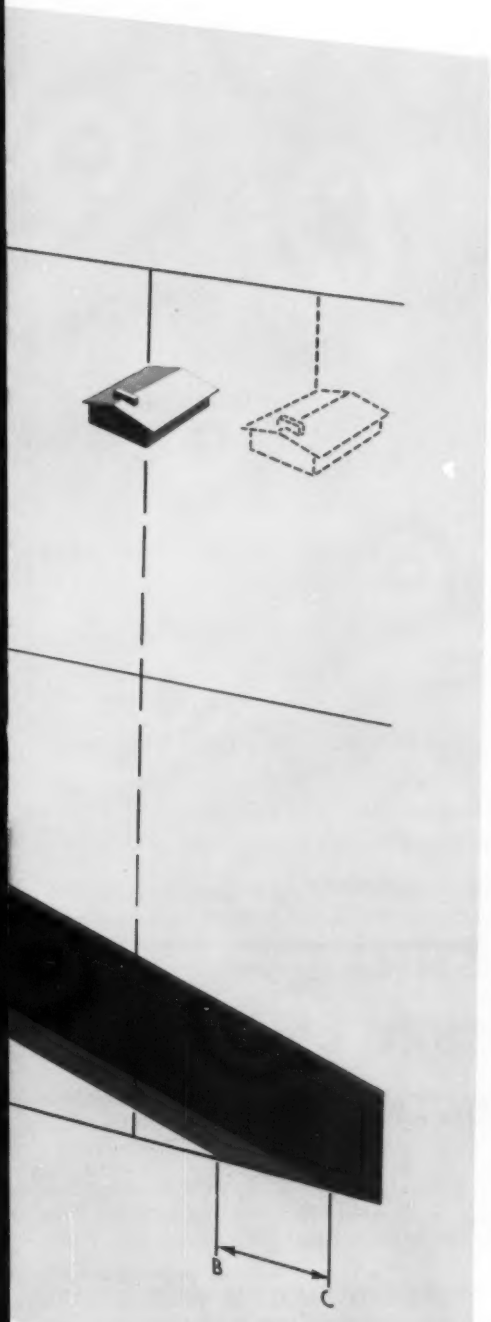
Right—URL regulator . . . over 10 years of field experience has proved the superiority of 1¼% step regulation.

YOU CAN BE SURE...IF IT'S Westinghouse



"Here are the facts," says Roy L. Brown, Mgr. Voltage Regulator Engineering.

"At Point A—other regulators use more allowable voltage drop. Exposed orange bandwidth indicates the extra line drop available for load growth when using Westinghouse 1¼% regulation. Similarly, the distance B-C represents additional margin for load growth or line extension when using URL or URF Westinghouse regulators."



It's a fact . . .
Westinghouse 1-1/4% step regulation

holds narrowest effective bandwidth, gives you more revenue

Westinghouse 1-1/4% step regulation more effectively meets the three basic distribution voltage conditions — you gain a narrower effective bandwidth; permits heavier loads, less line equipment.

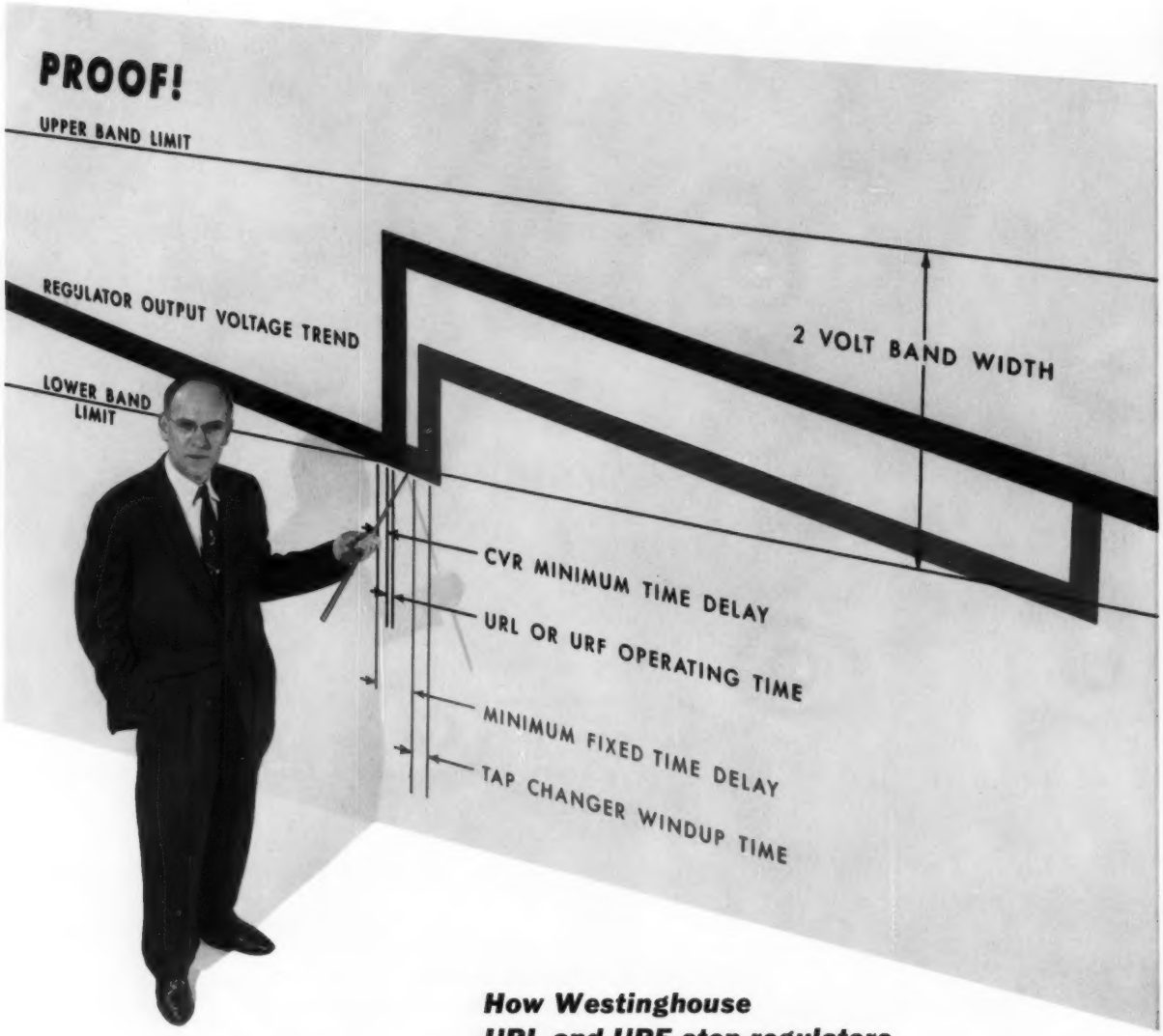
Here is what Westinghouse new URL and URF step voltage regulators can do for you:

1. Save you money because satisfactory voltages can be furnished to loads farther out on the line.
2. Increase revenue by allowing heavier loading of existing lines, hold effective regulator voltage bandwidth closer to the limits set on the control.
3. Because of faster relay operation on large voltage changes and a tap changer that responds 15 times faster than other types of mechanisms, URL and URF regulators provide protection against runaway voltages which can damage user equipment.
4. Make possible a minimum total regulation equipment investment:
   (a) Longer lines
   (b) Fewer regulators
   (c) Deferred expansion to meet growing loads

YOU CAN BE SURE... IF IT'S Westinghouse

This is system operating flexibility you get with no other regulators

HERE'S WHY . . .



How Westinghouse URL and URF step regulators

meet all THREE basic voltage conditions more effectively

THE PURPOSE OF A REGULATOR is to maintain an effective voltage level which will provide top operating revenue consistent with the least possible equipment investment and minimum maintenance.

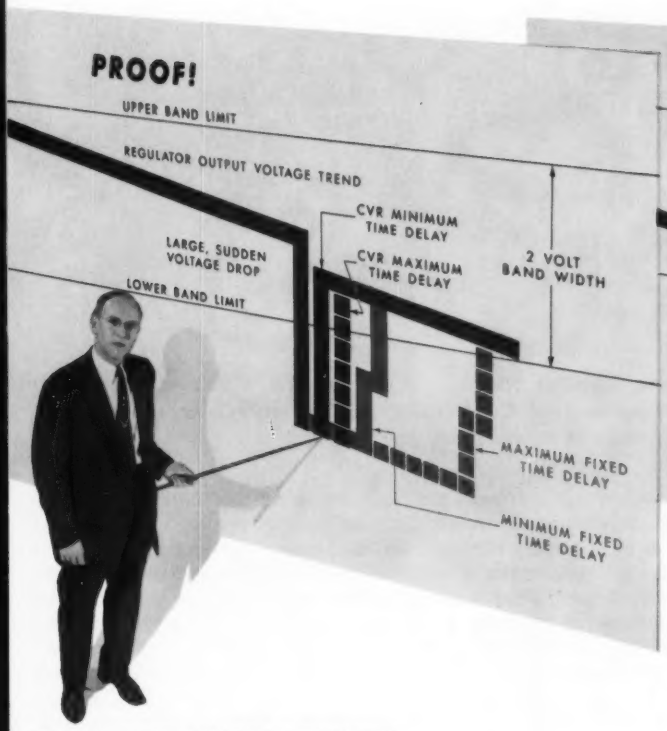
THREE EXCLUSIVE WESTINGHOUSE REGULATOR FEATURES give you this optimum voltage correction. (1) The unique new CVR voltage regulating relay with integral, adjustable, inverse time delay; (2) the instant-response tap changing mechanism, and (3) the 1¼% step giving regulation on a 120-volt base of 24 volts in 16 steps of 1½ volts each.

SMOOTH VOLTAGE CHANGES

Fixed time delay on ordinary regulators allows voltage to go outside band limit before operation. The Westinghouse CVR induction disc relay "reads" voltage. When lower or upper band limit is reached, contacts close; instant-response tap changer corrects voltage 15 times faster than other tap changers.

RESULT . . .
A NARROWER EFFECTIVE BANDWIDTH

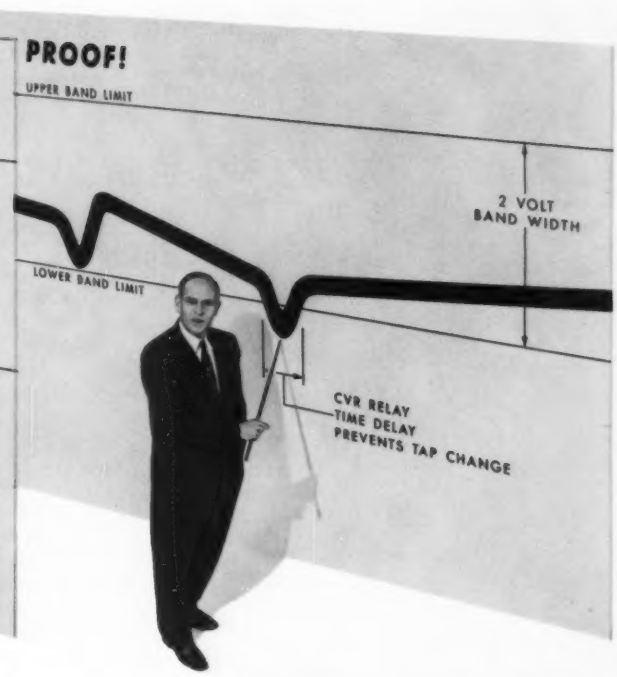
YOU CAN BE SURE...IF IT'S



LARGE, RAPID VOLTAGE CHANGES

CVR relay disc accelerates to close contacts and operate instant-response tap changer in a fraction of the time taken by other regulators. Because of the fixed time delay of ordinary regulators, steep voltage changes may run voltage so far above or below set band limits that two or more ¾-volt steps are required to bring voltage within the band. Westinghouse regulators, however, offer the quickest recovery under such voltage conditions.

RESULT . . .
A NARROWER EFFECTIVE BANDWIDTH



IRREGULAR VOLTAGE CHANGES

Westinghouse CVR relay induction disc with its damping magnet integrates voltage and time; its inverse time delay characteristic prevents relay and tap changer operation during self-correcting conditions.

RESULT . . .
NO UNNECESSARY OPERATIONS

New CVR relay "reads" voltage, evaluates need for correction, eliminates unnecessary tap changes

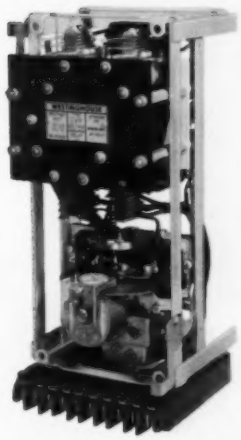
CVR voltage regulating relay is an induction disc device with built-in inverse time delay characteristics. On a smooth, slow-changing voltage (Figure 1), the disc position will follow the voltage, and will close contacts to start corrective action by the tap changer whenever voltage reaches pre-set band limits.

Ordinary regulators with fixed time delay allow wider voltage deviations from set limit.

But in the Westinghouse URL and URF regulators, the CVR relay operates immediately . . . voltage is restored to within band limits. Result—narrower *effective* bandwidth.

On large, rapid voltage changes, such as may result from switching in other parts of the system or from rapid load changes (Figure 2), the CVR relay disc *accelerates*—contacts are made, and again corrective action by the tap changer starts immediately. Voltage is quickly restored to normal. Result—narrower *effective* bandwidth.

Finally, irregular voltage changes (Figure 3), such as result from motor starting, are usually short-time, self-correcting disturbances. The Westinghouse CVR relay disc integrates voltages —automatically provides time delay through the averaging effect of the damping magnet. Prevents unnecessary operations which would lead only to increased maintenance.



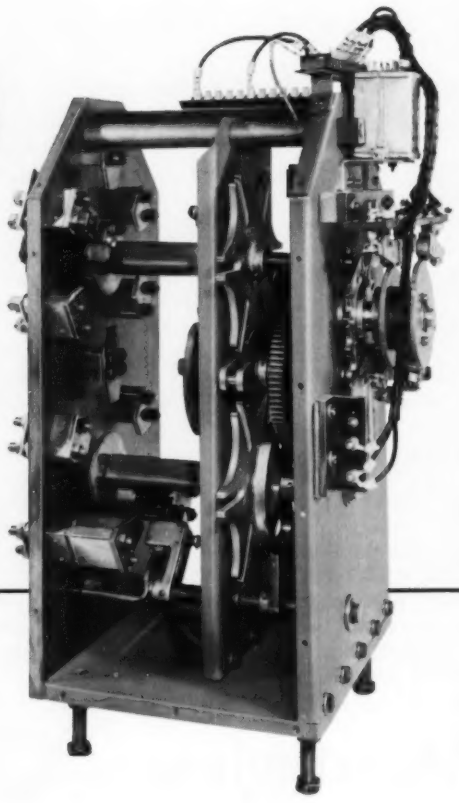
Unique new Westinghouse CVR relay with inverse time delay characteristics . . . provides best voltage regulation available under all voltage change conditions.

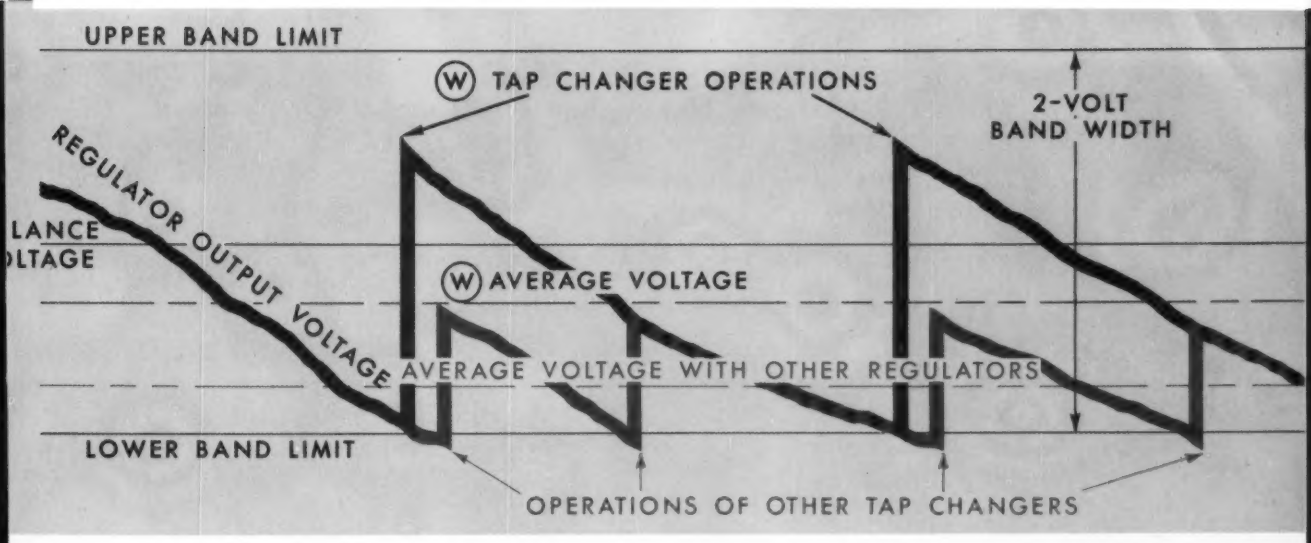
Westinghouse

Instant-response tap changer corrects voltage . . . 15 times faster than other tap changers

How Westinghouse direct-drive Geneva gear tap changer and CVR relay work together to achieve narrowest effective bandwidth

The *direct-drive Geneva gear* tap-changing mechanism responds instantly to the command of the voltage regulating relay. As soon as the relay contacts close, the tap changer motor starts driving the Geneva pinion. No windup time is involved. The pinion engages the Geneva gear and immediately moves the tap changer contacts to the next position. The advantages of directly driving the Geneva gear are dramatically illustrated in a comparison of time required for Westinghouse regulators to traverse from maximum raise to maximum lower with that of other regulators. The directly driven Geneva gear can, if so directed by the CVR relay, operate the tap changer over full range in only 13 seconds. Other drives require 3½ to 5 minutes from maximum raise to maximum lower. The elimination of this unnecessary time delay further contributes to A NARROWER *EFFECTIVE* BANDWIDTH.





Effective voltage of 16-step regulation is closer to balance voltage . . . with fewer operations

When a 2-volt bandwidth is used, the voltage level will always be more than one volt from the balance voltage when the relay initiates a tap change. With its 1½-volt steps, the Westinghouse URL and URF tap changers will bring voltage back to the balance level with a single operation; whereas, a ¾-volt step regulator will never bring voltage back to this level.

Westinghouse 16-step regulation means . . . 42% fewer operations, 15% less contact erosion. Result? Reduced maintenance, longer life

Optimum contact speed minimizes burning

Contact speed and burning are directly related—excessive burning of contacts will occur with either too slow or too rapid contact break. The former delays arc extinction, the latter frequently causes flashover between stationary contacts. Exclusive Westinghouse direct-drive Geneva gear mechanism consistently assures optimum speed. Arc extinction is achieved at first current zero. Flashover is eliminated, burning minimized, contact life significantly lengthened.

Contact burning and frequency of operation

Contact burning or erosion does not increase directly as the size of the step; therefore, the contact burning for one 1½-volt step is less than for two ¾-volt steps. Tests have shown that, on the average, the 16-step tap changer makes 42% fewer operations than a 32-step tap changer, and that the 16-step contacts average 15% less erosion for the same service. These two factors make 16-step operation result in reduced maintenance and longer life.

YOU CAN BE SURE...IF IT'S Westinghouse

Here is what new Westinghouse URL and URF regulators do for you:

- Hold a narrower *effective* bandwidth
- Provide protection against runaway voltages which can damage user equipment
- Increase revenue by permitting heavier loading of existing lines
- Save you money because satisfactory voltages can be furnished to loads farther out on the line

ADD TO THIS THE WESTINGHOUSE LOAD RANGE SELECTOR . . . allows higher currents at reduced range operation. With LRS, you get increased capacity on all URL-URF regulators . . . 160% of rated current at plus or minus 5% regulation up to 400 amperes.

Only Westinghouse offers these moneysaving product features:

- Separate tap changer compartment
- Inverse time delay relay
- Direct-drive Geneva gear tap changing mechanism
- 42% fewer tap changer operations
- Longer life contacts
- Corrosion-resistant tank

Get more revenue for power delivered. Specify new Westinghouse URL-URF regulators on your system. J-70804

YOU CAN BE SURE... IF IT'S Westinghouse

Air Conditioner Supermarket

Air conditioner merchandizing got a shot in the arm recently in Houston, Texas, with the opening of a supermarket-type operation exclusively for A.C units. The new store is the third in an appliance chain, called "Standard Brands," owned by R. O. Farmer.

According to Farmer, the store will carry 10 different lines, ranging from ½-ton window units to 5-ton central systems. To make shopping easy, some 100 units are wired right at the display counter, so that they can be demonstrated. A total of 2,000 units will be on display. The store employs about 50 people, some 22 of which are trained salesmen. The balance is made up of service and installation technicians. The store will also provide A.C. engineering services.

Southwest Utilities Meet to Promote Electric Heat

Sales and advertising people from four Southwest power companies met recently in Dallas, Texas, to put together a coordinated program for pushing electric heating. The meeting, at the invitation of Middle West Service Co, covered heat pumps and resistance heating.

Utilities represented were: Central Power & Light Co, Corpus Christie, Texas; Public Service Co of Oklahoma, Tulsa, Okla.; Southwestern Gas & Electric Co, Shreveport, La.; and West Texas Utilities Co, Abilene, Texas.

All four are planning a coordinated program built around:

- A manual for **builders, architects and contractors** to explain the advantages and characteristics of electric heating.
- A handout piece for **customers,** to be distributed from company offices, meetings, county fairs, etc.
- A presentation for the training of **employees and trade allies,** such as dealers and distributors.
- **General promotional aids,** newspaper ads, radio and TV spots.

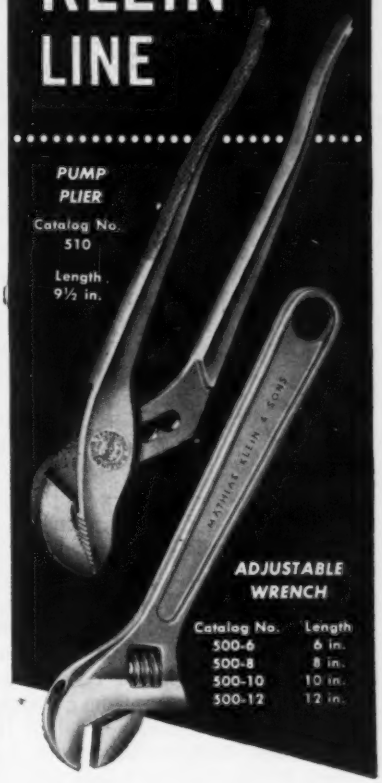
According to M. R. Rodgers, vice president of Middle West, the meeting came about as a result of the interest evinced at Electrical World's Electric Heating Conference held in December.

N. J. Mart Gets Big A.C.

Four 2,250-ton York centrifugal compressors, said to be the largest in the world, will form the heart of the air conditioning system going into the new mammoth Garden State Plaza Shopping Center in Paramus, N. J. They will provide 9,000 tons of cooling in the 110-acre mart.

(*More Selling on page* 124)

2 NEW PRODUCTS in the KLEIN LINE



These new high-quality tools have been added to the Klein line.

A Pump Plier that gives easy one-hand operation and a firm grip in any of four positions.

And the new Klein Adjustable Wrenches of drop-forged alloy steel, light in weight, chrome plated for lasting protection and service.

Write for Bulletin

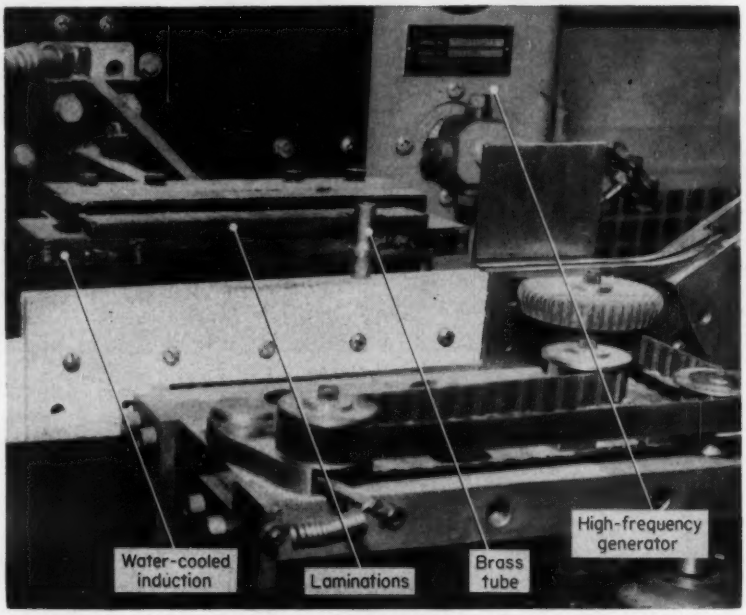
Bulletin No. 1157 on these two Klein tools is now available. Send for your copy.

Mathias KLEIN & Sons
7200 McCORMICK ROAD • CHICAGO 45, ILLINOIS

High Frequency Speeds Up Heat Treating

R. O. SMITH, Industrial Power Engineer, Connecticut Light & Power Co, Meriden, Conn.

High frequency induction heating was the solution to a mass production heat treating problem at the Master Engineering Co, a Cheshire, Conn. stamping and wire forming firm. A 10-kc induction heater, with a 7.5-kw output, anneals a selected portion of small brass tubes and turns out the finished pieces at the rate of 480 per minute. A special work coil or inductor, specifically designed for the job, heats the brass tubes uniformly and evenly to an annealing temperature of 600 F. The water cooled inductor is made of copper tubing, with iron laminations tightly compressed on three sides. The copper tubing has a dual function, carrying both the high frequency current and the water used to cool the device. The tubing is shaped to concentrate the lines of flux and control the area to which heat is applied.



INDUCTION HEATER, SPECIALLY DESIGNED for the job, operates at 10 kc. Rig anneals brass tubing at 600 F, turns out more than 480 pieces per minute

The two principal problems confronting Master were to anneal only a specific portion of the tubes and to do the job at an exceedingly fast rate in order to be competitive. The pieces are fed in from a hopper, pass along a track in front of the one-sided inductor, and then fall into a water quench when they are finished. The one-sided inductor assures even heating and moves the piece along the track. The directional path of the flux produced by the inductor causes the piece to rotate as it passes the inductor.

A 230-v, three-phase 15-hp motor drives the high frequency generator. The brass piece is approximately 1.5-inches long, has a 0.25-inch diameter.

Many thousands of pieces have now been annealed to exacting specifications and the owners are highly satisfied with the machine. As an extra bonus, the machine can also do specialty hardening of tools and machine surfaces.

Purchased Power Speeds Delivery, Trims Mill Costs

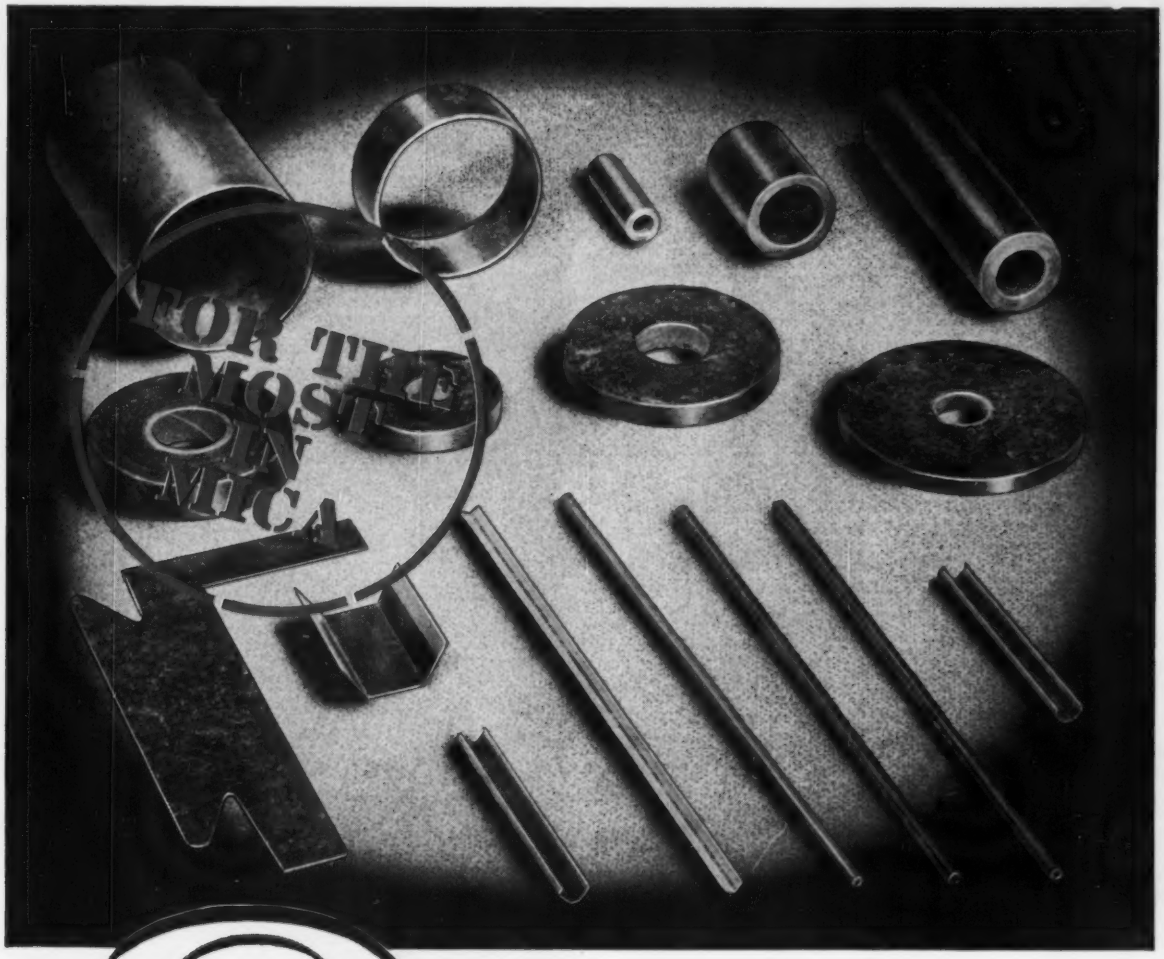
CLYDE OBERHOLZER, Power Sales Engineer, Pennsylvania Power & Light Co. Lancaster, Pa.

Replacing a 90-hp diesel with purchased electric power cut operating costs and speeded up the delivery schedule at the M. S. Graybill & Sons feed mill in Bareville, Pa. With a reliable supply of power, the company can now operate all the feed mill equipment at the same time.

Purchased power meant less expense for supervision and maintenance plus savings in insurance and interest on investment. But down-time losses were the big factor. When a diesel generator failure threatened to tie up Graybill's production of custom ground and mixed feeds, for two weeks, Pennsylvania Power & Light moved in and had the wheels spinning in ten days despite a four-day downpour.

Total mill demand is 100 kw. The largest portion of the load is made up of a 75-hp hammer mill, two 7.5-hp mixers, and a number of conveyors, all operated at 240 v. The customer is served at 12 kv through power company transformers. A substation composed of three 37.5-kva transformers provides the 240-v in-plant distribution voltage.

Highly pleased with the savings and improved operation, the customer is now considering installation of a pellet-making machine and additional mixing and material handling equipment.



WIDEST EXPERIENCE!

Just as there is no substitute for Mica in many insulating applications, there is no substitute for experience in producing mica products and parts. Macallen Mica is backed by more than 60 years experience in cooperating with the electrical industry. So, you can be sure of getting what you need.

SEND FOR CATALOG!

It's easy-to-use, self-indexed form saves hours of time in selecting the Macallen Mica products you need.

THE MACALLEN COMPANY

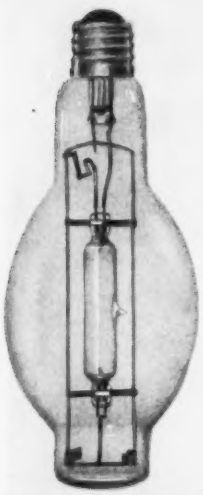
BAY ROAD, NEWMARKET, N. H.

565 W. Washington Blvd., Chicago 6, Ill.
1231 Superior Ave., Cleveland 14, Ohio

SPECIFY **MACALLEN MICA**

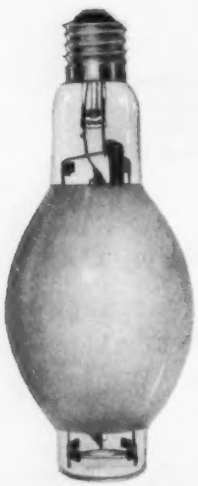
FOR THE MOST IN MICA

MAKING AMERICA'S

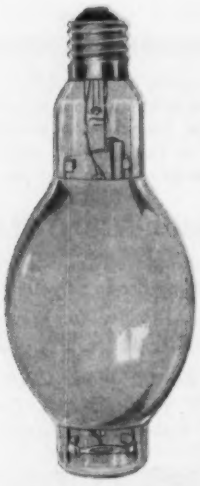


WESTINGHOUSE MERCURY LAMP E-H1—A 400 W. clear-glass quartz lamp designed for horizontal mounting; maximum illumination in a smaller lamp. 21,000 initial lumens make it ideal for city and highway lighting.

WESTINGHOUSE MERCURY LAMP E-H1-Y—Identical to the E-H1 except that a clear yellow filter of high transmission is permanently fused into the glass. For use in standard globe.



WESTINGHOUSE FLUORESCENT MERCURY LAMP J-H1—400 W. glass quartz lamp, color-corrected for golden-white light. Wide distribution of light from the luminaire due to large effective size of the light source.



WESTINGHOUSE FLUORESCENT MERCURY LAMP J-H1-Y—Identical to J-H1 except that it has a yellow filter in addition to its yellow phosphor coating. Approximates color of sodium closely enough for substitute installations.

Westinghouse

HIGHWAYS SAFER...

Mercury Lamps

SPEED WITH SAFETY... that's the objective of today's highway engineers. Highway lighting must make super-highway speeds safe, warn of special conditions miles ahead.

That's why more and more planners and builders of roads are turning to Westinghouse to solve their lighting problems. And that's why more and more Westinghouse Mercury Lamps are going into service daily. Modern clear-glass Westinghouse Mercury Lamps give virtually shadow-free, high-level visibility . . . and with Westinghouse yellow Mercury Lamps, turn-offs and danger areas can't be missed.

Two new Westinghouse yellow Mercury Lamps, E-H1-Y and J-H1-Y, may be simply substituted for uncolored lamps in standard fixtures where a yellow light is wanted, eliminating external filters or colored globes.

MORE WESTINGHOUSE MERCURY LAMPS ARE IN USE TODAY THAN ALL OTHER MAKES COMBINED

Not only does Westinghouse make more kinds and types of Mercury Lamps than anyone else, their pioneering leadership pays off in *substantial installation and operating economies.*

Westinghouse Mercury Lamps give more light when new . . . more light for a longer life. This means maintenance and replacement costs are cut . . . without sacrificing vitally needed light levels and safety standards.

BASIC CONSTRUCTION ADVANCES are another reason why you should specify Westinghouse for street, road and highway. For instance:

- **Thorium-Coated electrodes provide** HIGHER LIGHT OUTPUT
- **Molybdenum Ribbon Seal assures** GREATER DEPENDABILITY, LONGER LIFE
- **Hi-Temp Life-Time Base eliminates** INSTALLATION AND SERVICE BREAKAGE

Get the full story from a trained lighting expert who understands your problems. Write or call WESTINGHOUSE LAMP DIVISION, BLOOMFIELD, N. J.

YOU CAN BE SURE...IF IT'S

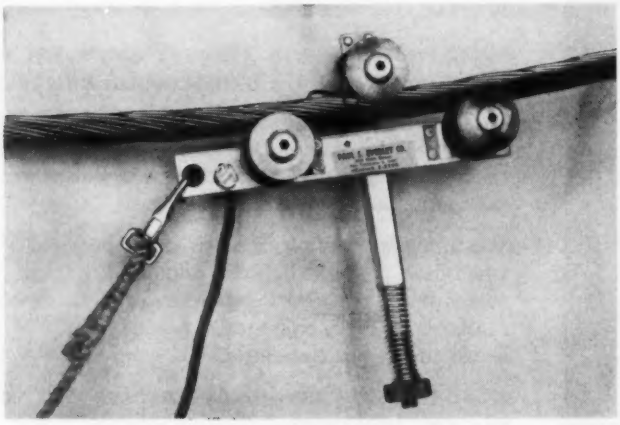
Westinghouse

NEW EQUIPMENT

Hole Digger . . .

. . . **bores holes up to 9 ft 4 in. deep, at various angles,** in practically all soils. Auger is guided, travels up and down on twin column support that turns, extends, or retracts to fit working conditions. Called "Earth-Master", digger can be used on existing hydraulic derricks or new equipment. Reversible hydraulic motor drives auger, separate motor raises and lowers digger. Augers up to 20-in. diam. and special heads for difficult soils are available. Auger swings out of way to permit pole setting.

McCabe-Powers Auto Body Co, 5900 N. Broadway, St. Louis 15, Mo.



Moving Cable Ground . . .

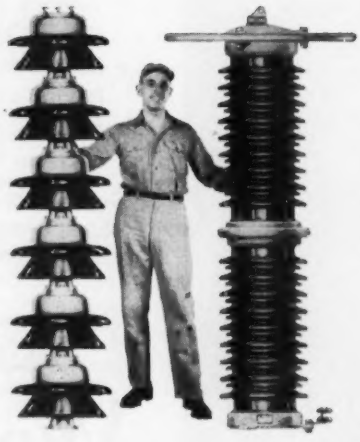
. . . **keeps positive ground on conductors during stringing,** reduces burns and fatalities caused by accidentally energizing cable during handling. Known as Ever-Ground, it snaps on to line easily. Secured at reel or cross arm by rope line, it floats on moving cable, keeping it grounded. Rollers are high contact metal, need no oiling. Large coil spring keeps rollers in firm contact with conductor. Sizes to fit all cable diameters are available.

Paul S. Everly Co, 550 Ninth St, San Francisco 3, Cal.

Lightning Arrester...

. . . **is small, has long interrupting distance.** It stretches arc to 140 times original length, has 7.3-in. interrupting distance per kv. High voltage station type is approximately height of standard switch insulator stack of same voltage rating. Electrically continuous porcelain housing reduces external leakage failures. Dynagap takes 90% of 60-cps power follow current limiting duty. Type MPR has line to ground ratings of 79 to 276 kv; Type MP, 3 to 73 kv; Type GP, 3 to 121 kv.

Ohio Brass, Mansfield, Ohio



Portable Power Plant . . .

. . . **for emergency power and flood lighting** has capacities from 10 to 100 kw, 110 or 220 v, single-phase or 3-phase. Unit mounts on two or four-wheel high speed trailers. Revolving field separately excited 0.8-p.f. generators are powered by liquid cooled gasoline or diesel engines with sensitive governor regulations to maintain frequency variations of less than 3 cycles.

Control panel has voltmeter, ammeter with control transformers and selector switch, frequency meter, manually operated exciter field rheo-

(*Continued on page* 130)

For lowest cost trenching . . .

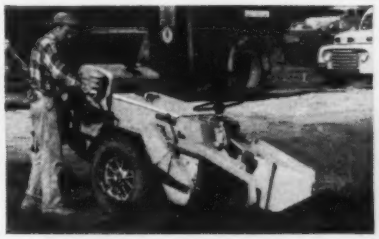
New Model 774 Wheel Ditcher for the big jobs up to 5'6" deep, 30" wide. Ideal for pipeline work. Exclusive Hydra-Crowd allows infinite range of digging speeds to 31 ft. per min. Unique flexible connection between chassis and wheel. Floating differential. All-hydraulic spoil conveyor. Hydraulic controls.

Model 705-B Runabout for scattered jobs up to 4' deep, 10½" wide. 15 m.p.h. road speed. Exclusive vertical boom digs right up to obstructions, leaves no ramp. Hydra-Crowd permits infinitely variable crowding speeds from 0 to 16 ft. per min. Fluid coupling prevents shock loads.

choose the ditcher that's right for you

The first step in reducing ditching costs is to select the machine that meets your requirements. Ground conditions . . . digging range . . . travel speed between jobs—all are factors that change with varying trenching operations. That's why Barber-Greene builds *five* distinctively different ditchers, each with special features that give it unsurpassed performance in its field.

Model 711 for widely scattered jobs. 45 m.p.h. travel speed. Digs to 5' deep and 18" wide. One-man operation. Hydra-Crowd assures maximum crowding speed for every digging condition.



Model 702 for narrow trenches to 5" wide, 40" deep. Ideal for cable, conduit, or small pipe. Easily moved. Varidraulic drive gives finger-tip control of crowding speed from 0 to 20 ft. per min.

Model 44-C for heavy-duty trenching. It cuts to 8'3" deep, 24" wide. 15 digging speeds from 1 to 11 ft. per min., or available with Hydra-Crowd with infinitely variable speeds from 0 to 7 ft. per min.

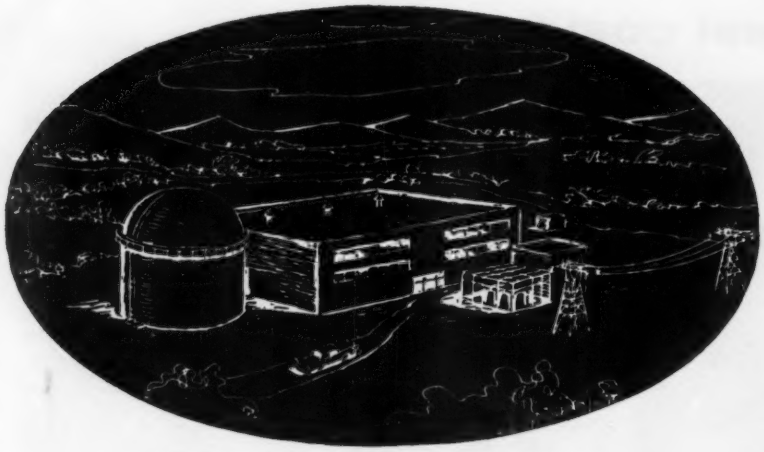
Literature on request.

57-8-D

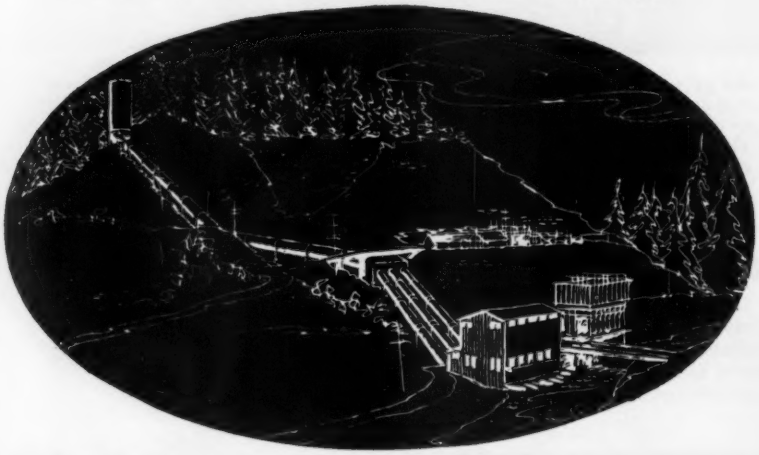
Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

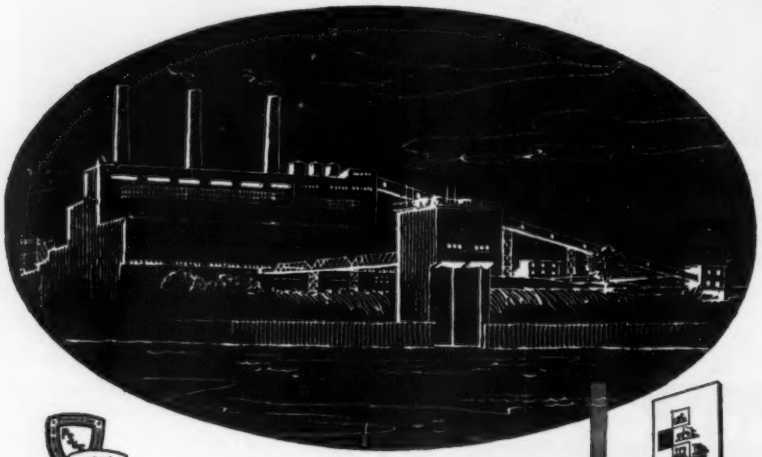
CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT



PUTTING **POWER** INTO
YOUR EXPANDING PROGRAMS



ATOMIC, HYDRO and FOSSIL FUEL POWER PLANT DESIGN
FOR INDUSTRIALS and UTILITIES



55 YEARS

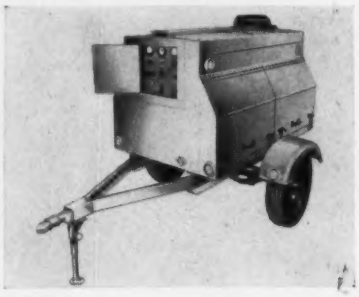
Pioneer Service & Engineering Co.

231 South La Salle Street • Chicago, Illinois

Send for our descriptive booklet, "Pioneering New Horizons" of these and other services.

Portable Power Plant

(*Continued from page* 128)



stat, and automatic voltage regulator. Unit can be equipped with up to four 80,000-C.P. floodlights which are adjustable to any position. Equipment is designed and distributed by Graybar Electric Co, Inc.

Windpower Mfg Co, Newton, Iowa

Outdoor Switchgear . . .

. . . **in weatherproof enclosure has sheltered aisle** for all-weather operation and maintenance. Space permits two breakers to pass side by side. Known as Shelterfor-M, metal-clad units use standard indoor switchgear with front drawout breakers. Eliminating front and rear doors, design requires up to 40% less plot space. No operating or breaker drawout pad is required. Interlocking steel floor plates support heaviest breaker and manpower load. Screened ventilating openings are provided.

Westinghouse Electric Corp, P.O. Box 2099, Pittsburgh 30, Pa.

(*More New Equipment on page* 132)

NEW *Wheeler* LLB (*linear, low brightness*)

. . . the first low brightness mercury street and highway luminaire!

. . . the first directional luminaire for divided highways and one-way streets!

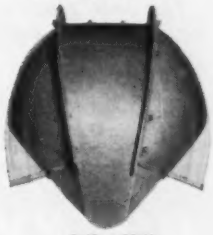
Wheeler blazes new trails in street and highway lighting . . . introduces the first large, low brightness luminaire that provides all the advantages of elongated (linear) street lighting luminaires *plus* the high efficiency and optical control which no other linear type can give . . . introduces the first practical directional luminaire which slashes energy costs for lighting one-way streets and divided highways by one-half — *Wheeler's contribution to the national highway lighting program.*

The latest example of Wheeler *street lighting pioneering* in action, this 4-ft. long LLB luminaire unit is available in standard I. E. S. street lighting patterns and can be supplied with integrally mounted Fisher-Pierce photoelectric controls. For full information on this sensational new development, see your Wheeler Sales Representative or write today to:

Wheeler Reflector Company
STREET LIGHTING DEPARTMENT
275 Congress Street, Boston 10, Mass.

STANDARD UNIT

DIRECTIONAL UNIT



END VIEW

WHEELER REPRESENTS THE MOST ADVANCED ENGINEERING IN STREET LIGHTING

ALUMINUM
OR GALVANIZED STEEL
SUPPORT SYSTEMS
FOR POWER AND CONTROL CABLES
IN-FREE-AIR
DESIGNED AND DEVELOPED BY HUSKY PRODUCTS

Mr. Engineer...

Mr. Contractor...

HUSKY
CABLE SUPPORT SYSTEMS
are NOT ONLY
RECOMMENDED and APPROVED
by ALL Leading
CABLE MANUFACTURERS
They are actually SOLD by
MOST of the large cable
manufacturers.

NO OTHER
POWER CABLE SUPPORT
SYSTEM HAS THIS DISTINCTION.

DO YOU KNOW WHY??

The only "electrically sound" system; let us explain...
or...ask your cable manufacturers representative.

ALSO...
Send for your copy of the story of
"CABLE IN-FREE-AIR"

AVAILABLE THROUGH LEADING CABLE MANUFACTURERS

HUSKY PRODUCTS, INC.
5300 VINE STREET, CINCINNATI 17, OHIO

Drafting Desk . . .

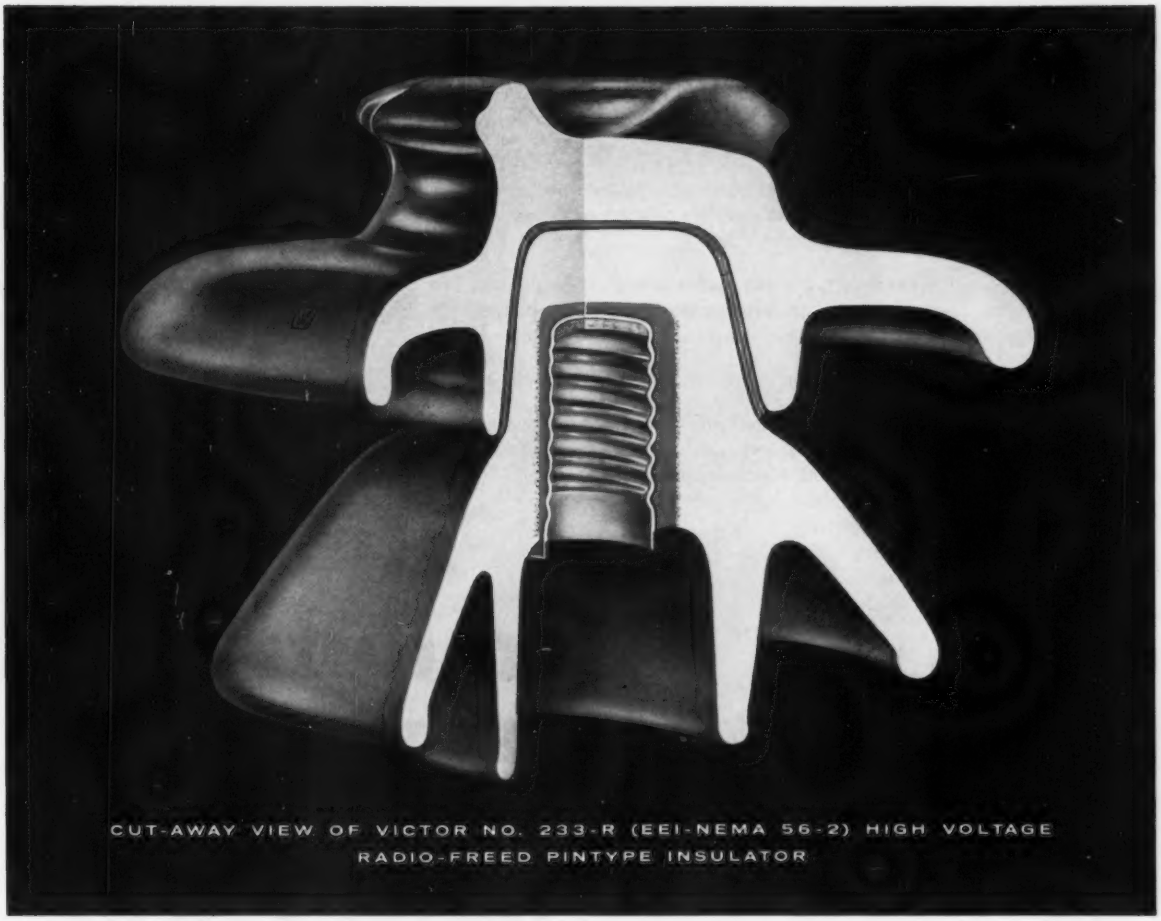
. . . **combines drafting surface, reference table, and storage** area, reducing space requirements in crowded drafting rooms. Designated the Draft-a-Matic, it has all-metal construction to reduce fire hazard. Compactness allows increase in number of work stations and in space between tables. Typical installation doubled space between tables, boosted number of tables in room from 140 to 145.
General Fireproofing Co, Youngstown, Ohio

Modular Switchboard . . .

. . . **handles seven types of low-voltage protective devices** in almost any combination. Designed for incoming services of 600 v or less, the Type DR Universal board accepts breakers, fused interrupter switches, and breaker-current limiting fuse combinations. Unitized modules permit complete layout and dimensioning from published data, simplify subsequent rearrangements or additions.

Rated 800 through 4,000 amp, mains are horizontal bus bars mounted in center of each section. Two separate vertical bus bars, rated 600 v each, are center fed from main, leaving top and bottom free for cabling. Extra vertical buses can raise section capacity to 4,800 amp. Standard bus bracing is 50,000 amp rms asymmetrical (40,000 amp symmetrical); 100,000 amp rms asymmetrical (85,000 amp symmetrical) bracing is optional. All bus bars are silver plated.
General Electric Co, Plainville, Conn.

(*More New Equipment on page* 135)



CUT-AWAY VIEW OF VICTOR NO. 233-R (EEI-NEMA 56-2) HIGH VOLTAGE RADIO-FREED PINTYPE INSULATOR

VICTOR HIGH VOLTAGE PINTYPES COST NO MORE THAN ORDINARY INSULATORS!

VICTOR High Voltage Pintypes are the industry's greatest value! Only with VICTOR do you get premium quality insulators without paying premium prices.

These insulators are laboratory designed, manufactured and tested with the industry's most modern equipment. They are made of VICTOR *Purified* Porcelain—finest insulator porcelain ever made. They are *precision* made. Shells are accurately aligned. Machine-spun zinc thimble assures perfect pin fit. VICTOR'S radio treatment, *distinguishable* and *permanent*, eliminates your radio interference problems.

Scientifically fitted glaze gives added strength and added protection against contamination. Beaded edges give higher impact strength. Each insulator is designed to withstand steep front impulse waves in addition to the normal 1.5 x 40 standard impulse wave. Full size, smooth top and side grooves insure proper conductor seating. When you buy VICTOR, you just can't buy better high voltage pintypes—at *any* price!

Nothing beats Porcelain **FOR ELECTRICAL INSULATORS!**

VICTOR INSULATORS DIVISION

I-T-E CIRCUIT BREAKER CO., INC. • VICTOR, N.Y.

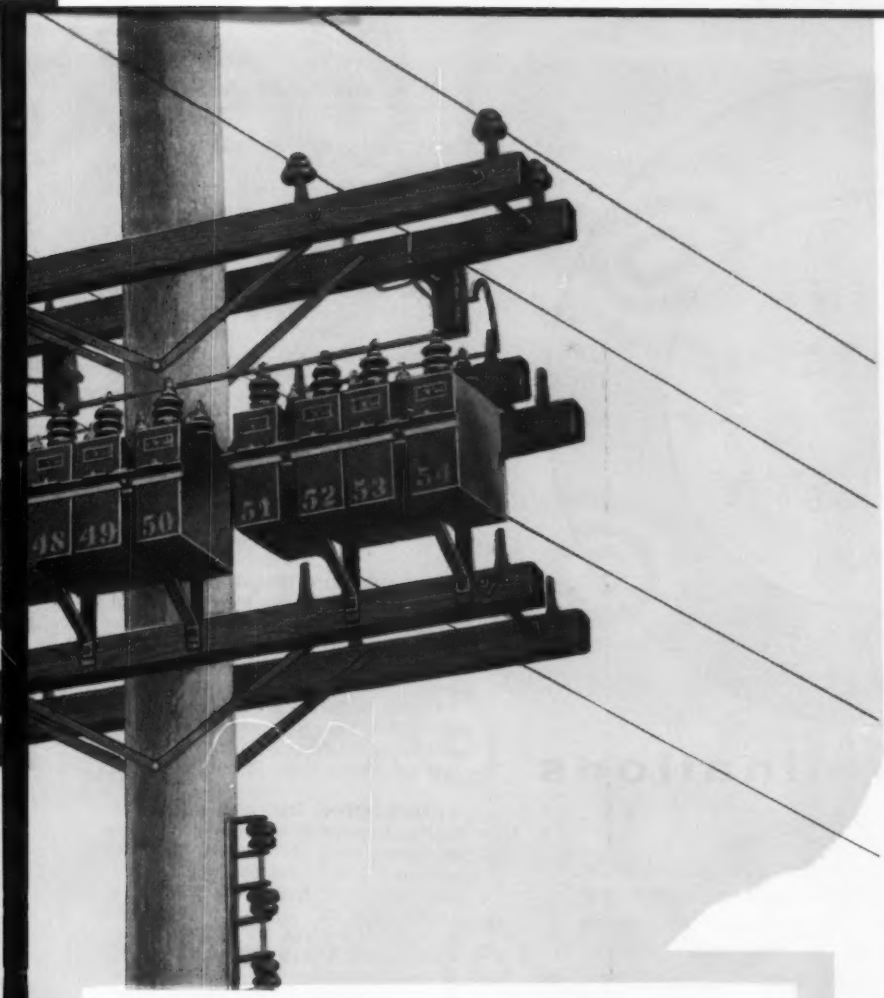
WITH C-D CAPACITORS THERE'S NO GUESSING. The field performance records speak for themselves. Capacitors installed over 20 years ago, are still operating trouble-free — 24 hours a day.

The reasons? Because of C-D's basic and thorough understanding of capacitor utilization problems . . . design research that anticipates emergency needs . . . scrupulous inspection . . . rugged construction . . . conservative ratings.

Invest your purchasing dollar in internal quality — the only place where it counts.

Insure low-maintenance service from your next power-factor capacitor installation, by talking it over first with a C-D engineer. Just write Cornell-Dubilier Electric Corporation, Dept. D-77 South Plainfield, New Jersey.

You don't have to guess with C-D power-factor capacitors...



Here's why C-D Capacitors consistently exceed all field performance requirements:

• Lowest dielectric unit stress and highest major insulation level. • Dykanol-filled bushings increase accepted flashover safety-factor, insure high level of impulse withstand. • Removable solderless connectors. • Many sections in series-parallel connection. Extremely low voltage gradient per section; less heating; no corona; longer life; lower power-factor. • Discharge resistor connected to each series section, instead of terminal to terminal. Provides effective discharge for each series group and balanced voltage distribution. • Side mounted lifting lugs—stronger and avoid risk of flashover. • Energization tested, 100 percent, to assure uniform distribution of low dielectric losses.

CORNELL-DUBILIER

consistently dependable

power-factor capacitors

SOUTH PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER & CAMBRIDGE, MASS.; PROVIDENCE & HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD, FUQUAY SPRINGS & VARINA, N. C.; VENICE, CALIF.; & SUB.: THE RADIART CORP., CLEVELAND, OHIO; CORNELL-DUBILIER ELECTRIC INTERNATIONAL, N. Y.

Mill Motor . . .

. . . **in 620 frame is an addition** to manufacturer's line. It has Class H, silicone windings, capable of taking severe abuse. Round, fabricated frame is strong and compact. Frame is split horizontally to simplify inspection and maintenance. Motor can be furnished in totally-enclosed, protected self-ventilated, protected or enclosed forced ventilated designs.
Crocker-Wheeler Div, Elliot Co, Jeannette, Pa.

More New Products

Chromalox **liquid-tight radiant heaters** come in 27 standard lengths. Standard wattages are 800 to 7,200 w; voltages are 120, 240 and 480 v. —Edwin L. Wiegand Co, 7500 Thomas Blvd, Pittsburgh 8, Pa.

Portable gas detector measures concentrations of natural gas from zero to 100%, is useful in testing manholes and valve boxes.—Johnson-Williams, Inc, Palo Alto, Calif.

Small fish tape winder, called the Jr Tape-Mate, is designed for 8-inch diam. reels. Operator can wind or unwind without touching tape.—Holub Industries, Inc, Sycamore, Ill.

Dustproof and weatherproof **floodlight** for 400-w mercury vapor lamps is designated No. 400P. It also accommodates incandescents up to 500 w.—Nepo Mfg Co, 4230 N. Sayre Ave, Chicago 34, Ill.

Product life tester, Type 1000, provides on-off power cycles adjustable from 0.1 sec to 15 min, can break 15-amp circuits.—Paraplegics Mfg Co, Franklin Park, Ill.

Load center line for residential service features plug-in operation and split bussing, contains two to 42 positions.—Murray Mfg Co, 1250 Atlantic Ave, Brooklyn, N. Y.

Rugged **photoelectric relays,** made without amplifier tubes, can be used for smoke alarms. Measuring 4.5-in. high, they operate on 100 to 130 v.—Photobell Co, Inc, 43 Vesey St, New York 7, N. Y.

in wire terminations

The world's finest silver bears a hallmark as proof of quality—the world's finest electrical product, which daily speeds and comforts your way of life, likewise bears a stamp of approval assuring the quality and reliability of its wire terminations.

In every piece of electrically powered equipment there are many points of potential failure—places where the wires forming the arterial network begin and end. These are the points, deep within the facade, where AMP quality and precision engineering is most appreciated.

A-MP solderless terminals and application tools have been designed and developed to meet the specific wiring requirements of electrical motivation, whenever and wherever it is generated, distributed, utilized or maintained.

Through speed and dependability of application, AMP solderless wiring techniques are now bringing to the industries of several continents the increased production volume so necessary in this age of automated manufacture.

A-MP terminals, when required for maintenance and repair needs, are made available in the U.S.A. through American Pamcor Inc.

api AMERICAN PAMCOR INC.

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GENERAL OFFICES:

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Wholly Owned Subsidiaries: Aircraft-Marine Products of Canada Ltd., Toronto, Canada • Aircraft-Marine Products (Great Britain) Ltd., London, England • Societe AMP de France, Le Pre St. Gervias, Seine, France • AMP—Holland N.V. 's-Hertogenbosch, Holland

Distributor in Japan: Oriental Terminal Products Co., Ltd., Tokyo, Japan

CATALOGS–BULLETINS

• **AUTOMATIC SYNCHRONIZERS:** Rapid synchronizers of its Type F line are described and technical data and method of operation given in bulletin 2035 issued by Brown, Boveri & Co, 19 Rector Street, New York 6, N. Y.

• **TRANSFORMERS:** A catalog covering its line of testing, furnace, network, load center, dry type, and liquid immersed transformers is available from Queensboro Transformer & Machinery Corp, 115-25 Fifteenth Ave, College Pt, New York.

• **VARIABLE TRANSFORMER:** "Powerstat," a double wound variable transformer, is described in Bulletin SE-L3578 by Superior Electric Co, Dept LW, 83 Laurel Street, Bristol, Conn.

• **MOTOR CONTROL CENTER:** Description and application of its Unitrol, standardized motor control center, has been issued in a 32-page booklet by Cutler-Hammer Inc, Milwaukee, Wis.

• **FANS:** Bulletin J-611 covering its line of Axivane Fans for commercial and industrial applications is published by Joy Mfg Co, Oliver Bldg, Pittsburgh 22, Pa.

• **CORROSION:** Data on high temperature and corrosion service for engineers on B&W Croloy 18-8 Ti (AIS Type 321) is offered in ASL 288 by Tubular Products Division of Babcock & Wilcox Co, Beaver Falls, Pa.

• **SILICONE INSULATION:** Appraisal of rewinding motors with silicone insulation is furnished in a 6-page booklet, Code No. 10-104, by Dow Corning Corp, Midland, Mich.

• **THERMAL INSULATION:** A six-page brochure describing its "Thermasil" calcium silicate insulation for temperatures to 1,200 F has been published by Ehret Magnesia Mfg Co, Valley Forge, Pa.

• **UTILITY SETS:** Bulletin 8314 is the designation given by American Blower to the 52-page catalog covering its line of Sirocco Utility Sets. Write American Blower, Division of American Standard, Detroit 32, Mich.

• **HEATING AND VENTILATING:** Catalogue S316 describing its heating and ventilating products has been released by ILG Electric Ventilating Co, 15 Park Row, New York, N. Y.

• **STEAM GENERATORS:** Bulletin B-56-5 describes F-W's line of central station and industrial installations. Write Foster Wheeler Corp, 165 Broadway, New York 6, N. Y.

• **'GALVANOX':** A circular discussing uses of "Galvinox" in electric utilities and fabricators has been released by Subox, Hackensack, N. J.

(*More Catalogs on page* 138)

Where is the Guy who put up this guy?

He's doing something else—
maybe he's putting up another one.
Anyway, he did this job all alone
in less than five minutes—
by himself.

STRANDVISE is made
for strand sizes 3/16", 1/4", 5/16", 3/8", and 7/16"
NO MATTER THE GRADE.
Please pick your size, fill in
the coupon and mail it today.

Reliable

Reliable Electric Company
West Carroll Avenue
Chicago 12, Ill.

Mr. Reliable:

WE DON'T BELIEVE IT BUT—we want to give STRANDVISE a fair trial. You may send 4 of them size ( ) without charge. Better send your instructions for installing and a catalog-price sheet, too.

Signed_____

Company_____

Street No._____

City_____ State_____

IN CANADA — HAYES STEEL PRODUCTS LIMITED, MERRITTON, ONTARIO

This STRANDVISE guy was put up complete before any tensioning tools were applied to the strand

YOUR STREET AND HIGHWAY LIGHTING PROGRAMS NEED LUMATROL®

FULLY AUTOMATIC CONTROL

Three little words tell the big story about new LUMATROL Model S:

RELIABILITY...
SIMPLICITY...
ECONOMY...

Hundreds of installations across the nation prove LUMATROL to be the greatest single advance in outdoor lighting since the luminaire. It provides the kind of control that saves budgets, saves manpower, and reduces dusk to dawn accidents.

EXCLUSIVE FEATURES...
Omni-Directional Light Sensing ... No orientation ... Plug-in-out ... absolute stability with no calibration drift ... shrugs off extreme cold and heat, rain and snow ... No Phototube in circuit ... Weatherproof, crackproof cover ... Compact ... Harmonizes with any installation.

Write today for technical bulletin on LUMATROL MODEL S.

micro balancing
INCORPORATED
GARDEN CITY PARK, L. I., NEW YORK
Trade Mark Reg. U.S. Pat. Off.

Catalogs–Bulletins

(*Continued from page* 136)

• **ASBESTOS TEXTILES:** Printed by Union Asbestos & Rubber Co is a 16-page reference manual for application and temperature ranges of asbestos textiles. Write the company at Bloomington, Ill., for its UNARCO publication 76-327.

• **PNEUMATIC DRIVE UNITS:** Operating characteristics and mechanical specifications of pneumatic power drives for remote operation are included in Bulletin No. 1033, of the Copes-Vulcan Division, Blaw-Knox Co, Erie, Pa.

• **VARIABLE VOLTAGE ADJUSTER:** Variable voltage adjusters, manually set to cover a primary range of 65, 75, 90, 100, 115, 130 or 145 v with an output of 115 v are described in Catalog VA 312. The publication also covers the manufacturer's power voltage series over a primary range of 145, 160, 175, 195, 210, 225 or 240 v with an output of 115 v. Output voltage of 230 v is also available in both series. Address Acme Electric Corp, Cuba, N. Y.

• **ELECTRONIC DATA PROCESSING SYSTEM:** A brochure describing its Model S-2000 "Transac" electronic data processing system has been issued by Philco Corp, Government & Industrial Division, Philadelphia 44, Pa.

• **ELECTRON POWER TUBES:** A quick-reference catalog of its electron power tubes, has been made available by Eitel-McCullough, Inc, San Bruno, Calif.

• **CU & CU-ALLOYS:** Copper & Copper-Alloy Specifications Index, Publication B-34, lists the most generally used alloys and products of the manufacturer, gives a brief description of them and the chemical composition of all Anaconda metals covered by standard specifications. Address American Brass Co, Dept RS, Waterbury 20, Conn.

• **RADIANT HEATING PANELS:** PYREX Radiant Heating Panels, their uses and installation, are included in a booklet put out by Corning Glass Works, Corning, N. Y.

• **MOTORS & CONTROLS:** A brochure describes the complete line of ac and dc motors, gearmotors, motor-generator sets, controls and speed-adjusting equipment made by Reliance Electric & Engineering Co, 24601 Euclid Ave, Cleveland 17, Ohio.

• **CONTROL CENTERS:** A 16-page manual contains descriptive and pictorial material information on control centers manufactured by Square D Co, 4041 N. Richards Street, Milwaukee 12, Wis.

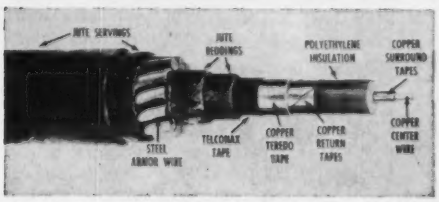
• **AIR PRESSURE:** Descriptions of barometers, vacuum gauges, and pressure gauges are found in Bulletin No. D-2 presented by Precision Thermometer & Instrument Co, 1434 Brandywine Street, Philadelphia 30, Pa.

Cable leaving ship's stern must withstand the rigors of installation and give long, efficient service. BAKELITE polyethylene plays a vital role in meeting these requirements. American portion of Trans Atlantic Cable supplied by **Simplex Wire and Cable Co.**, Cambridge, Mass.

How BAKELITE Polyethylene serves . . .

On the bottom of the Atlantic Ocean

The electrical and physical properties combined in BAKELITE Brand Polyethylene Compound DFD-6505 make it especially useful for service in submarine cable. Its insulation values are excellent and its rate of moisture absorption extremely low. Physical properties, such as light weight, flexibility and resistance to cracking at low temperatures, further equip it for the rigorous installation and operational requirements imposed by the undersea environment.



Cutaway photo shows complex structure of this cable.

These are some of the reasons why Bakelite Polyethylene DFD-6505 is being used for the inner insulation of the American segment of the North Atlantic telephone line and the Alaskan cable, reaching 1600 miles between the state of Washington and Alaska. Since 1950, over 4,000 miles of submarine cable have been insulated with DFD-6505.

BAKELITE Brand Polyethylene and Vinyl covered wire and cable meet the demands of the telephone and communication industries. To keep informed about the latest developments, you can receive regular copies of Kabelitems and other pertinent technical data. Simply send your request to Dept. XJ-53.

BAKELITE
BRAND
POLYETHYLENE

UNION CARBIDE

BAKELITE COMPANY, *Division of Union Carbide Corporation* • 30 East 42nd Street, New York 17, N. Y.

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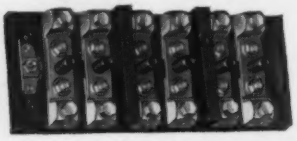
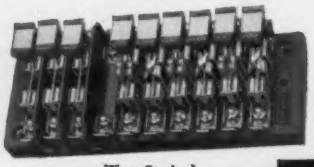
Look to Superior for
TEST SWITCHES AND BLOCKS



Test Block



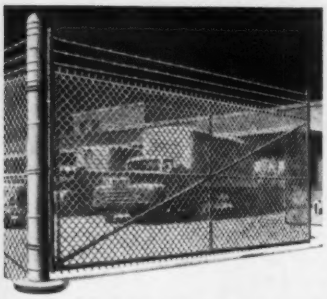
Test Switch

Superior also offers a complete line of
Enclosures
Socket Equipment
Test Tables

SUPERIOR
SWITCHBOARD & DEVICES CO.
CANTON, OHIO
A subsidiary of
The Union Metal Manufacturing Company

Catalog 55 offers complete information on features, services, type and sizes. Write to:

PAGE chain link FENCE
America's First Wire Fence—since 1883



LASTS LONGER—COSTS NO MORE
It's *Aluminized!*

• Here's important, money-saving news *for you.* By a patented process Page is producing a *great new wire* which provides better, longer-lasting fence protection at a substantial long-range saving. Commercially pure aluminum is bonded to fence fabric wire and thus combines the strength of steel with the corrosion resistance of aluminum. ASTM salt spray tests show that for equal thickness of coating, the new aluminized wire outlasts galvanized wire by more than 2 to 1, yet with all the advantages of this *new* fence fabric it costs no more to buy and install a Page Chain Link Fence with ACCO Aluminized Fabric. In terms of years of unfailing service your investment can be halved or more. And to be sure of expert, reliable workmanship your fence will be engineered and erected by a nearby, long-experienced member of Page Fence Association. For helpful Page data...

Write to PAGE FENCE ASSOCIATION, Dept. W, Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia or San Francisco.

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

BOOKS

Principles of Induction Heating

Induction Heating Practice. By D. Warburton Brown. Published by Philosophical Library, Inc, 15 E. 40th St, New York 16, N. Y. 189 pages, illustrated. Price $10.00

This highly practical book provides an excellent insight into the induction heating practice, combining a wealth of detail with a simple, concise presentation. No prior knowledge of induction heating is necessary. Theory is limited to a short general survey of coil design and hardening. A few simple algebraic formulas are the only mathematics involved.

Chapters on soldering and brazing are characterized by thorough treatment of materials and accessories such as fluxes and solders. Material on heat treatment and gear hardening has numerous specific examples. Additional chapters on component design and locating jigs and fixtures emphasizes the production slant of the book. Simple, functional illustrations contribute to the effectiveness of the material.

Applied Thermo

Engineering Thermodynamics. By C. O. Mackey, W. N. Barnard, and F. O. Ellenwood. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York, 16, N. Y. 428 pages, illustrated. Price $7.95.

This book covers the basic principles of engineering thermodynamics including properties and processes of real gases. Also covered are ideal gases, ideal gas reactions, energy transformation in turbines, power cycles with real fluids, refrigeration, and air conditioning.

It is based on an earlier book entitled, "Heat Power Engineering" by Barnard and Ellenwood. In most instances the fundamentals are explained in terms of applications to practical processes or cycles. Nevertheless rigid mathematical treatment is used throughout. It is not a "survey" type of book.

Primer on Electricity

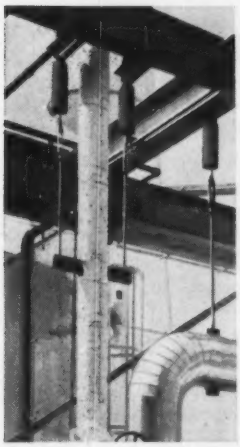
Basic Electrical Principles, 2nd Edition. By M. G. Suffern. Published by McGraw-Hill Book Co., Inc., 330 West 42nd Street, New York 36, N. Y. 454 pages, illustrated. Price $4.00

This is a textbook designed to aid in the training of electrical trade students on a vocational-education level. The author has made great use of sketches to explain the basic principles. This new 2nd edition contains new photographs of electrical appliances. Portions of the text have been rewritten to bring it up-to-date. Use of mathematics and physics is held to a minimum.

BLAW-KNOX has what it takes—to provide these products and services

Large chrome moly pipe being readied for shipment to new generating station. Making a right angle bend followed by a 24 degree, 18 foot bend in this heavy 27½ inch chrome moly pipe required all the skill and modern facilities of the Blaw-Knox power piping shop. Before shipment, piping is heat-treated and ultrasonically tested with a radar-type device for detection of any defects.

A new Blaw-Knox "6 x 6" Flexibility Matrix Method of computing stresses in power piping systems is now available to consulting engineers, companies, and individuals responsible for the design of power piping systems. By the use of an electronic computer this method cuts calculating time from months to a day; assures full accuracy to six significant figures; and has no limitations on the complexity of the system. Write for further information about our new "6 x 6" Flexibility Matrix Method.



Two-way control over movement of piping is provided by Blaw-Knox functional spring hangers with the patented internal swivel action—shown in this modern outdoor generating station. Our experienced engineers are available to both design and make recommendations for your hanger requirements. To get full information, write for Catalog No. 54.

Each year serious fire strikes one out of every seven manufacturing firms in this country. Be safe. Let a Blaw-Knox fire-protection engineer study your needs —and explain how you can pay for the system on our lease or deferred payment plan. To get more information send for Bulletin No. 2426—"Fire Can Destroy Your Business."

BLAW-KNOX

BLAW-KNOX COMPANY

Power Piping and Sprinkler Division

829 Beaver Avenue • Pittsburgh 33, Pennsylvania

Complete facilities for prefabrication and erection of piping systems for all pressures and temperatures
. . . complete line of standard and custom-engineered pipe hangers, supports and vibration eliminators
. . . complete line of automatic sprinkler systems for standard and special hazards

Step-Regulator Marks 25th Anniversary

Forerunner to today's step-voltage regulator is marking the 25th Anniversary of its installation. In service on a 20-mile rural distribution line of the Appalachian Electric Power Co, the step-regulator is shown above being inspected.

The problem that led to the development of the unit was the need for a simple and low cost regulator. Before 1932 the induction regulator with complicated mechanism and twice the expense was the only type unit available.

Engineers of the American Gas & Electric Co had an idea of using a tap-changer-under-load driven by a motor which in turn was controlled by a regulating voltmeter.

"The idea was turned over to GE and the result was the first step-voltage regulator. GE advertised it in ELECTRICAL WORLD that year . . . In 1937 GE again advertised the regulator . . ." according to the ILLUMINATOR of AEPC.

T. F. Hildebrand, now AG&E Service Corp agricultural development engineer, wrote a 3½-page article on the step-regulator. Entitled "First Step-Regulator Installation", the article was published in ELECTRICAL WORLD, May 20, 1933, pp. 650-653, from which the following is quoted.

"The first installation of this new type voltage regulator was made in September, 1932, on the Roanoke-Fincastle 6,900/12,000 Y-v line of the Appalachian Electric Power Co near Roanoke, Va. The results were not only very gratifying from a functional standpoint but also from the cost angle, the total installed cost of the regulator being about half the estimated cost of the cheapest other remedy considered. . . . The total installed cost of the Fincastle line regulator, including regulator, line lightning arresters, complete mounting and subsequent adjustments, was about $3,250.

"The step-regulator installed on this line was a 50-amp, 1,080-kva, three-phase unit for 6,900/12,000-Y-v operation with four 2½% voltage tap positions above and below the nominal 12,500 v position. This permits the source to range from 11,250 to 13,750 v, the regulator maintaining approximately the nominal 12,500 v on the load side."

Automatic Electric Moves

Automatic Electric Co is moving its facilities from Chicago to suburban Northlake, Ill. The new plant is on a 167-acre site and has more than 1,520,000 sq ft.

Pennsylvania Transformer Constructs Research Lab

Work has been started recently on a transformer sound level laboratory at the Canonsburg plant of Pennsylvania Transformer Division, McGraw-Edison Co.

This research laboratory will cost approximately $1 million, according to A. L. Horelick, engineering manager. It is one of several Thomas A. Edison Laboratories to be built by McGraw-Edison. This building will provide facilities for research on methods to reduce noise in electrical equipment.

Design of the laboratory, which will contain a large anechoic chamber capable of testing greater than 100,000-kva transformers for noise reduction, is under the direction of Charles C. Honey, electrical research engineer. Scheduled for completion at the end of the year, the laboratory is being constructed on a seven-acre tract adjacent to the present Pennsylvania Transformer plant.

Westinghouse Adds Fourth Plant for F-HP Motors

Production of fractional horsepower motors has been started by Westinghouse Electric Corp in an automated plant at Upper Sandusky, Ohio. This is the fourth plant for such manufacturing by the company's Small Motors Division.

While the plant is mechanized and conveyorized to a high degree, flexibility exists to enable manufacture of both shaded-pole type 1/30 to ⅛-hp, and permanent-split capacitor type, 1/30 to ¼-hp motors. About 30 different styles and sizes are made in this 66,000-sq ft plant. They are used for direct-connected fan applications.

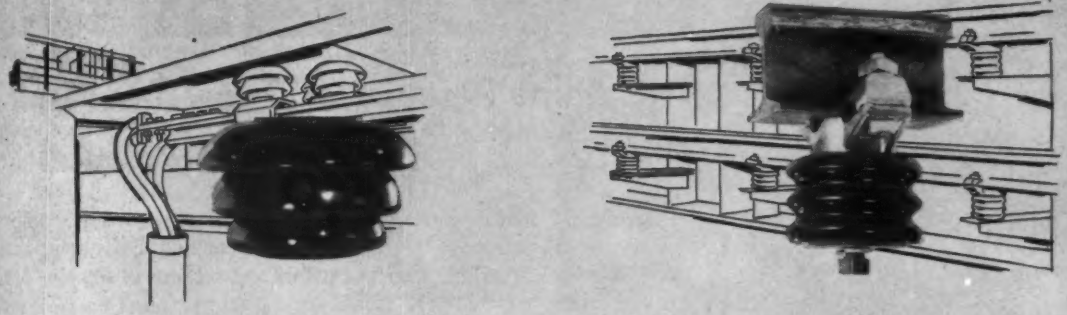
Even though the product is a seasonable one, the plant is to operate the year round piling up reserves in the slack season. These motors now have a 5-year guarantee as do other parts of air-conditioning units.

(*More M & M on page* 144)

STRENGTH

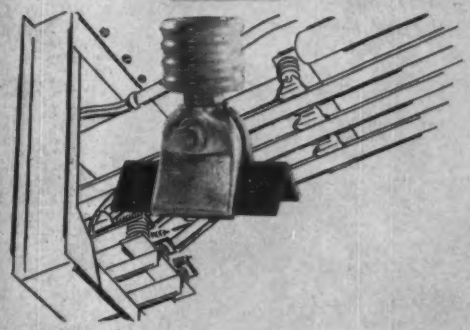
Which kind of strength do you need in insulators for traveling-contact equipment?

MAXIMUM ELECTRICAL STRENGTH



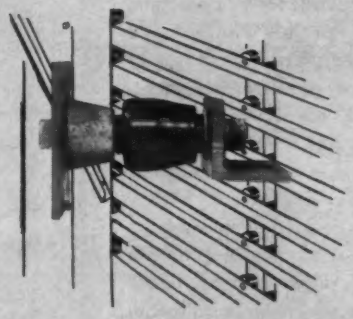
Wet-process porcelain insulators, such as these, offer outstanding electrical properties for high-voltage contact-rail insulation. Especially recommended where dirt, moisture, and other contaminants prevail.
Also available are dry-process porcelain units for power circuits.

MAXIMUM IMPACT STRENGTH



Molded polyester-fiberglass insulators and fabric-reinforced insulators of this general type have exceptional impact strength and vibration-resistance combined with good electrical properties. Tailored to resist chemicals, thermal shock, weathering.

MAXIMUM TENSILE STRENGTH



Molded Giant Strain insulators, adaptable to miniaturization where space is restricted, offer unusual mechanical strength. A very economical insulator having diverse applications.

TO HELP YOU DECIDE . . .

. . . on the right combination of properties to meet your insulator needs, Delta-Star engineers from coast to coast invite your problems. Phone the nearest Delta-Star district office or write to Electric Service Works, Delta-Star Electric Division, H. K. Porter Company, Inc., 17th & Cambria Sts., Philadelphia 32, Pa.

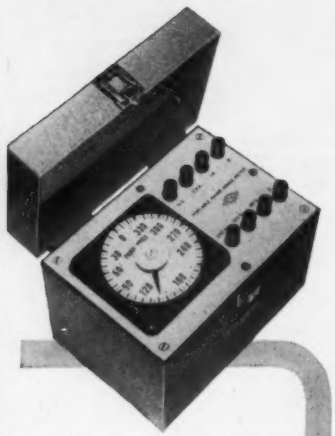
ELECTRIC SERVICE WORKS

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.

Divisions of H. K. Porter Company, Inc.: Connors Steel, Delta-Star Electric, Henry Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings, H. K. Porter Company (Canada) Ltd.

PORTABLE PHASE ANGLE METER



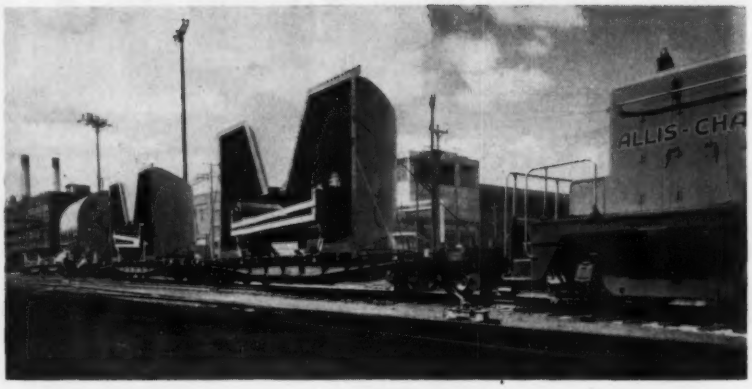
Completely self-contained, and requiring no auxiliary equipment for its operation, this Portable Phase Angle Meter offers a direct way of checking relay and instrument connections, particularly directional over-current relays, differential relays or similar equipment. It may also be used to measure the prevailing power factor in each phase of a polyphase watthour meter installation. The device has a frequency of 60 cycle, with voltage ranges of 60, 120 and 240 volt. Current ranges are 1, 2.5 and 5 amp. . . . DIMENSIONS: 9½ x 6¾ x 5⅝ in. Weight 19 lbs.

Also available in other voltage combinations

Write for Bulletin #75 for complete information

EASTERN SPECIALTY CO.

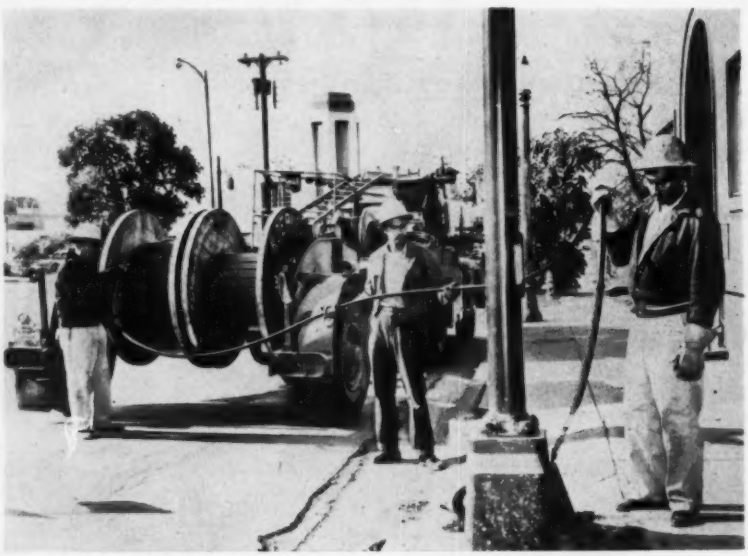
PHILADELPHIA 40, PA.



A-C Ships Parts of 300-Mw T-G Unit

Components of the first 300-Mw steam turbine-generator unit are loaded on the cars for transportation to Detroit Edison Co's River Rouge generating station.

Shipment is made from Allis-Chalmers West Allis Works. The parts being shipped for the 3,600/1,800-rpm close-coupled, cross-compound reheat unit are—one of the generator stators and sections of the low pressure exhaust casing.



Bakelite Covering Eases Installation

Bakelite coverings are being used on cables for the traffic control system installation by the City Public Service Board of San Antonio, Texas.

High tensile strength, multi-conductor signal cable, made by John A. Roebling's Sons Corp, Trenton, N. J., are insulated with Bakelite polyethylene and jacketed with Bakelite vinyl plastic. As shown in the picture, the cable with its smooth outer jacket has been pulled 110 ft through 2-in conduit.

Time is being saved in installation by tieing cable, with bright colored jacket for identification, to terminal blocks instead of the usual splicing.

Bethlehem Awarded Flow Line Contract

A $3 million contract has been awarded the Bethlehem Steel Co, Bethlehem, Pa., to supply the necessary steel plate and to fabricate on the site a replacement for the remaining wood-stave flow line of the Pennsylvania Power & Light Co. The wood-stave line, built in 1924, leads from Lake Wallenpaupack in the Pocono Mountains to the PP&L hydroelectric plant in Hawley, Pa.

Bethlehem will furnish nearly 5,000 tons of steel plate and will weld it into about two miles of 14-ft diam tube. The steel company replaced previously 8,500 linear feet of the line in the autumn of 1956.

GE Receives Orders For Circuit Breakers

Orders for 50 magneblast air circuit breakers, each capable of interrupting 750 mva, have been given to General Electric's medium voltage switchgear dept. by Consolidated Edison Co, New York.

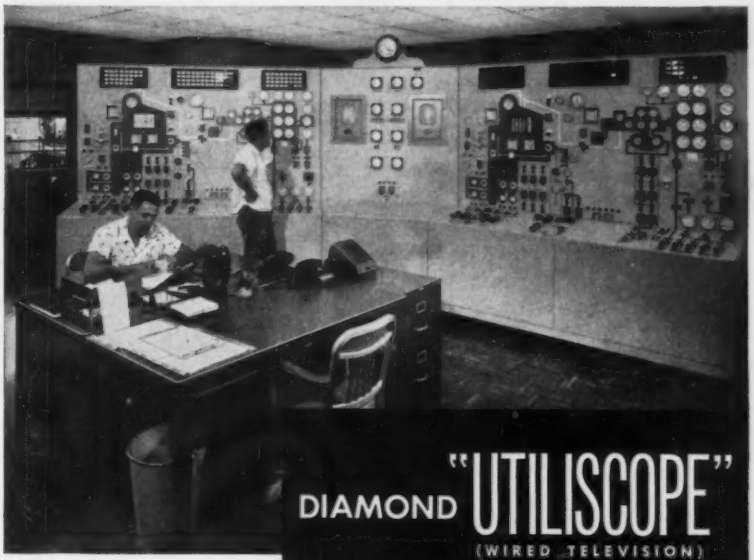
Designed to control large amounts of power and aid in substation distribution equipment short circuit protection, about half of the breakers will be in the Leonard St. substation. The remainder are for the E. 63rd St. station.

Besides these, orders totaling 57 have been placed by Baltimore Gas & Electric Co, by the City of Peru, Ind., by a midwestern utility, and by the Youngstown Sheet and Tube Co, Youngstown, Ohio. The latter will be the first known use of the 750 mva breakers in the steel mill industry.

C-H Has Low Noise Level

Cutler-Hammer, Inc, Milwaukee, Wis., has a high lighting level and low noise level in its recently completed $2 million plant. Lighting with mercury vapor lamps ranges from 60 to 140 ft-c. Fiberglas blankets, 2-in. thick, on the ceiling cut the overall noise level, reportedly, 30% to 40%.

AUTOMATION IN POWER PLANTS



DIAMOND "UTILISCOPE"
(WIRED TELEVISION)
HEAVY DUTY EQUIPMENT FOR VISUAL INFORMATION

"UTILISCOPE" CAMERA

"UTILISCOPE" RECEIVER

The Diamond "Utiliscope" makes possible the ultimate in automation for power plant control. It enables the operator to see clearly anything that requires visual check. He no longer need depend upon indirect interpretations to know what is happening outside his range of vision.

The operator in the above photograph is watching the ITV image of the water level in two boilers . . . transmitted by "Utiliscope" cameras focused on Diamond Bi-Color water gauges. The water levels are easily and unmistakably read on the viewing screens. There can be no error . . . the level is shown correctly or there is no picture.

The Diamond "Utiliscope" is heavy duty equipment for power plant application. Other power plant uses are: watching flame conditions in boiler furnances, watching smoke emission from stacks, and watching remote entrances for intruders. Have you explored the "Utiliscope's" resources for saving money and improving operation? Use the coupon below for further information.

Diamond

DIAMOND POWER SPECIALTY CORP.
FIRST IN INDUSTRIAL TELEVISION
LANCASTER, OHIO
OFFICES IN 39 PRINCIPAL CITIES
Diamond Specialty Limited—Windsor, Ontario
Since 1903, Diamond has Manufactured Quality Equipment for Industry

7800

DIAMOND POWER SPECIALTY CORP.
ELECTRONICS DEPT., P.O. BOX 57BB
LANCASTER, OHIO

Please send me without obligation a copy of bulletin showing how Diamond Industrial (Wired) Television will help me reduce costs and improve operations.

Name_____

Title_____

Company_____

Address_____

MEETINGS CALENDAR

JULY

Southeastern Electric Exchange—Personnel Administration Section Conference, John Marshall Hotel, Richmond, Va., July 25-26.

• **American Power Dispatchers Association**—Southwest Area Summer Meeting, Lemon Grove, Calif., July 27.

AUGUST

Western Electronic Show and Convention—Annual Meeting, Cow Palace, San Francisco, Calif., August 20-23.

• **Electric Companies Advertising Program**—Copy Group Meeting, Seaview Country Club, Absecon, N. J., Aug. 22.

American Institute of Electrical Engineers—Pacific General Meeting, Pasco, Washington, Aug. 26-30.

SEPTEMBER

American Institute of Electrical Engineers—2nd Special Technical Conference and Exhibit on Magnetic Amplifiers, Hotel Penn Sheraton, Pittsburgh, Pennsylvania, September 4-6; Sixth Annual Industrial Electronics Symposium, co-sponsored with Institute of Radio Engineers, Morrison Hotel, Chicago, Ill., Sept. 24-25.

Instrument Society of America—12th Annual Instrument Automation Conference and Exhibit, Cleveland Auditorium, Cleveland, Ohio, Sept. 9-13.

Illuminating Engineering Society—National Technical Conference, Biltmore Hotel, Atlanta, Ga., Sept. 9-13.

Electric Companies Public Information Program—Steering Committee, New York City, Sept. 11; Workshop Conference, Whittier Hotel, Detroit, Mich., Sept. 25-27.

Maryland Utilities Association—33rd Annual Fall Conference, Cavalier Hotel, Virginia Beach, Va., Sept. 13-14.

Edison Electric Institute—Accounting Division Organization Meeting, jointly with AGA, Lemington Hotel, Minneapolis, Minn., Sept. 19-20; Industrial Relations 10th Annual Round Table Conference, Drake Hotel, Chicago, Ill., Sept. 23-25; Meter & Service Committee, Hotel Nicolet, Minneapolis, Sept. 23-25, Electrical Systems and Equipment Committee, Cosmopolitan Hotel, Denver, Colo., Sept. 30-Oct. 1.

• **Southeastern Electric Exchange**—Engineering & Operation Section, Biltmore Hotel, Atlanta, Ga., Sept. 19-20.

Public Utilities Association of the Virginias—39th Annual Meeting, White Sulphur Springs, West Virginia, Sept. 19-21.

American Society of Mechanical Engineers—Fall Meeting, Statler Hotel, Hartford, Conn., Sept. 23-25.

Electric Companies Advertising Program—Copy Group Meeting, Detroit, Mich., Sept. 25.

OCTOBER

Pennsylvania Electric Association—50th Annual Meeting, Bellevue-Stratford Hotel, Philadelphia, Pa., Oct. 2-3.

Indiana Electric Association—French Lick-Sheraton Hotel, French Lick, Ind., Oct. 2-4.

International Association of Electrical Leagues—Annual Conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, October 2-5.

National Industrial Conference Board—Atomic Energy Course for Management, Hotel Moraine on the Lake, Highland Park, Ill., Oct. 6-12.

Iowa Utilities Association—Management Conference, Hotel, Fort Des Moines, Des Moines, Iowa, Oct. 7-8.

American Society of Mechanical Engineers—Lubrication Conference, sponsored jointly with American Society of Lubrication Engineers, Royal York Hotel, Toronto, Canada, Oct. 7-9; Power Conference, Americus Hotel, Allentown, Pennsylvania, Oct. 21-23.

National Electronics Conference, Inc—13th Annual Meeting, Hotel Sherman, Chicago, Ill., Oct. 7-9.

American Institute of Electrical Engineers—Fall General Meeting, Morrison Hotel, Chicago, Illinois, October 7-11.

Edison Electric Institute—Area Development Workshop, Phoenix Hotel, Lexington, Ky., Oct. 9-11; Transmission & Distribution Committee, Statler Hotel, Boston, Massachusetts, October 17-18; Accounting Division Taxation Accounting Committee, held jointly with AGA, Williamsburg, Va., Oct. 23-24.

• **Southeastern Electric Exchange**—Accounting Section, Fort Sumter Hotel, Charleston, S. C., Oct. 10-11; Sales Section, Tutwiler Hotel, Birmingham, Ala., Oct. 16-18.

Rocky Mountain Electric League—54th Annual Convention, Broadmoor Hotel, Colorado Springs, Colo., Oct. 13-17.

Interstate Power Club—Hotel Martinique, New York City, N. Y., Oct. 14.

Oklahoma Utilities Association—Electric Light and Power Division, Woodward, Okla., Oct. 25; Eastern District, Bartlesville, Okla. Oct. 25.

Atomic Industrial Forum—Annual Conference, New York City, Oct. 28-30.

American Nuclear Society—Winter Meeting, New York City, Oct. 28-30.

National Association of Railroad Utilities Commissioners—Annual Conference, Peabody Hotel, Memphis, Tennessee, October 28-31.

Industrial Management Society—21st Anniversary Industrial and Management Clinic, Hotel Sherman, Chicago, Ill., Oct. 30-Nov. 1.

Institute of Radio Engineers—3rd Annual Technical Conference of the Professional Group on Electron Devices, Shoreham Hotel, Washington, D. C., Oct. 31-Nov. 1.

NOVEMBER

Edison Electric Institute—Accident Prevention Committee, Penn-Sheraton Hotel, Pittsburgh, Pa., Nov. 6-8.

Pacific Coast Electrical Association—Hawaiian Conference, Reef Hotel, Honolulu, Hawaii, Nov. 7-8.

Institute of Radio Engineers—Third Annual Instrumentation Conference, Atlanta Biltmore Hotel, Atlanta, Georgia, Nov. 11-13.

National Electrical Manufacturers Association—Traymore Hotel, Atlantic City, N. J., Nov. 11-15.

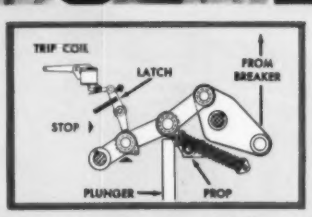
Electric Companies Public Information Program—Inter-Regional Committee, Mayflower Hotel, Washington, D. C., Nov. 19.

• Additions this week.

Large Unit Going Up in Delaware

Delaware Power & Light Co is erecting a 150-Mw unit at its Edge Moor station, with double capacity of any unit now in the company system. Meanwhile, DP&L's $31-million Indian River plant now under construction is slated to be completed this year. First unit will be 80 Mw.

For positive protection this Pneu-Draulic operated breaker is mechanically trip-free



This simple uncoupling linkage is key to protection

Contacts can open at full rated speed with the Allis-Chalmers mechanically trip-free mechanism regardless of position of closing mechanism.

Breakers that are only pneumatically or hydraulically trip-free can't give you this protection.

Pneu-Draulic is an Allis-Chalmers trademark.

Get details on this and other features of Allis-Chalmers breakers. Call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-5243

Allis-Chalmers unit substations limit today's costs to today's loads

HERE'S an outstanding new installation in the Middle West — a neat, compact, well built Allis-Chalmers substation — with a modern brick wall for good landscaping.

The initial investment for a 10,000-kva unit substation meets today's needs, and it's arranged to add another 10,000 kva with space available clear to the lot line.

And it's easy, with Allis-Chalmers completely factory-built and tested units, to add feeders, or another (or larger) transformer at any time — only space requirements need be preplanned by the utility.

A-534

Ask for Bulletin 1187912

For power where you need it, when you need it, for easy, time-saving installation, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *for progress in switchgear*

ELECTRICAL BUSINESS OUTLOOK

Electrical World
JULY 22, 1957

An uncomfortable budget squeeze between high interest rates on one hand and July price increases on the other puts purchasing agents of electric utilities in a tough spot. To find out how they're reacting Electrical World contacted some last week.

"We haven't gone into the market to beat these last increases," said one PA. This "wait-and-see" attitude is general even though most of the purchasing agents EW contacted foresee across the board price boosts.

Tight money hasn't affected buying of electrical equipment. "You have no choice," is the way another PA put it. But "this money situation and the price developments pose a double burden," he added. "Our management is very much concerned." And this reaction was typical.

Inventories are down to the bare minimums. Stocks are generally below what companies had on hand this time last year except where special construction is underway. "The fast moving items are practically all on a 30-day basis," a PA remarked. Said another: "We are holding down drastically. We're covering ahead no further than we have to."

A few PA's see price hikes as a move "to shake a lot of business loose." But, if this is the case, the strategy hasn't succeeded with agents EW talked to.

Following a slack period of orders for heavy transmission equipment, it appears that an upturn may be in the offing. Some pick-up in orders is seen later this year. "We've started buying these items now after a period of no orders," remarked one PA. "I think the drop is due to a lot of these items being bought after the war. The backlog is back to normal now," he said. Another PA looks for an upturn in 1958.

• • •

The consumer now holds the key to the long run business outlook. Odds are pretty good for a boomlet in consumer buying towards the end of this year. But for a real boom—one which will set a quick pace throughout '58—that's still a question mark. So far the economic indicators don't show it.

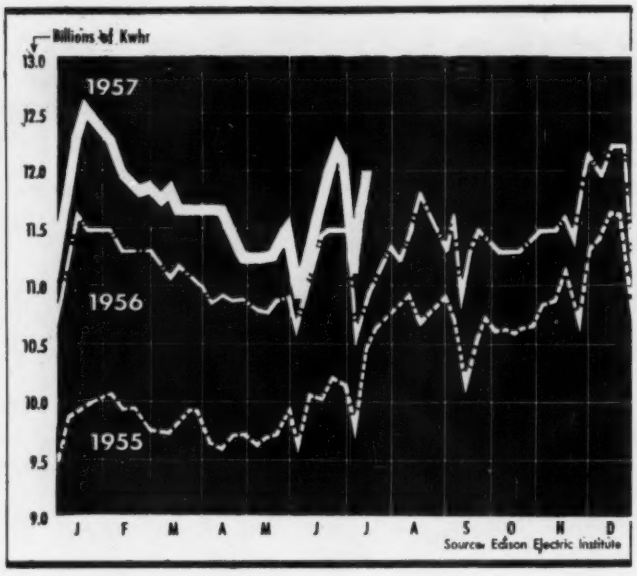
Actually consumer expenditures have been expanding steadily for the past two years. It's just that, compared to the buying spree of 1955, there hasn't been anything approaching a dramatic spurt. Right now this lull ties into:

• **Installment credit**—Since consumers are now paying off their past debts at a substantial clip, there hasn't been much of an increase in credit outstanding. Just look at the figures. In 1955, installment credit jumped $5.5 billion. In 1956 it rose $2.5 billion. But for the first five months of this year, credit increased by less than $400 million.

• **Personal income**—On a per capita basis, after-tax income hasn't been showing much gain. And in real terms (ie, '56 dollars) the first quarter figure for '57 was $1,700 a head—exactly the same as a year before. That's a pretty good explanation of why consumers aren't too bullish at this point.

What does this add up to? The heavy repayment of installment debts means that consumers will be in a better position to buy on the cuff later this year. But for a substantial surge in consumer buying the income factor is more crucial. Although there should be some real gains, it's still too early to tell.

STATISTICS



OUTPUT

Week ended July 13,
11,964,000,000 Kwhr
Up 10.0%

Per Cent Change From Previous Year

	June 29	July 6	July 13
Total U. S.	+ 5.3	+ 6.4	+10.0
New Eng.	+ 8.0	+ 0.7	+ 2.3
Mid. Atlan.	+ 7.9	+ 1.8	+ 6.2
Cent. Ind.	+ 2.4	+ 4.8	+11.9
West Cent.	— 0.6	+ 7.8	+18.6
Southeast	+ 7.2	+ 6.2	+ 7.7
South Cent.	+ 0.2	+11.1	+14.5
Rocky Mount.	+ 6.6	+ 7.7	+ 6.4
Pacific			
NW	+ 8.5	+ 8.7	+ 7.0
SW	+10.8	+13.5	+13.0

Seasonally Adjusted Index 231.4
Week Ago 232.3
Year Ago 210.4

Atomic Energy Commission requirements—1,150,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 10.9%.

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity } Peak—Class 1 Systems } million kw	May	122.79	122.27	117.43	4.6
	April	97.7	98.0	91.6	6.7
Estimated Dec. '57 Peak	April	113.6	113.5	114.1	— 0.4
Production—billion kwhr	May	51.70	50.67	49.09	5.3
Hydro		11.80	12.05	11.71	0.8
Fuel		39.90	38.62	37.38	6.7
Sales—billion kwhr	April	47.15	47.75	44.58	5.8
Residential		12.72	13.47	11.86	7.3
Commercial		7.25	7.35	6.71	8.0
Industrial		24.66	24.44	23.60	4.5
Other		2.52	2.49	2.41	4.6
Fuel Consumption	May				
Coal—million tons		12.60	12.50	12.05	4.6
Oil—million barrels		6.31	6.47	4.47	41.2
Gas—billion cu ft		108.66	98.80	110.51	— 1.7
Net Income Class A & B Co's—$ million	April	115.93	126.81	114.54	1.2
Residential Customers—millions	12 mos.	45.99	45.92	44.67	3.0
Revenue per kwhr	ended	2.59¢	2.59¢	2.63¢	— 1.5
Avg kwhr per customer	Mar. 31	3,021	3,004	2,820	7.1
Avg annual bill		$78.23	$77.80	$74.17	5.5

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	June	143	143	141	1.4
ENR Construction Cost	July	151.8	151.2	145.6	4.3
BLS Cost-of-living	May	119.6	119.3	115.4	3.6
New Orders for Machinery (1950 = 100)	May	148	145	157	— 5.7
NEMA Sales					
Insulation materials	April	145	153	163	—11.0
Electric appliances		83	97	111	—25.2
Wholesale prices	April				
Motors and generators		141.4	140.7	130.4	8.4
Transformers and regulators		147.4	147.4	135.3	8.9
Switchgear and fuses		164.4	164.4	149.0	10.3
GNP—annual rate—$ billion	1st Qtr.	429.1	426.0	405.2	5.9

MANAGEMENT BULLETIN

FINANCE

Electric utility stocks continue to be a "good buy" despite recent market drops, counsels Security Analyst Harold H. Young, Eastman Dillion, Union Securities & Co. In his recent letter to investors, Young wrote: "We have every reason to believe that purchases of utility stocks at the present time will ultimately work out very well although it is never possible to predict what trend the market will take during any short period." He notes that anyone who has purchased a list of good utility stocks at practically any date during the past 20 years and has held them has fared very well. Earnings and dividends have improved and stock prices have risen.

Two principal factors, Young believes, account for recent utility stock tumble. These are the competition from high interest rates and a recent rate case.

"There's no doubt that the level of interest rates has had impact," writes Young. "The income feature is one of the principal appeals of utility stocks. When it is possible to get the high income now available from both bonds and preferred stocks, these securities become competitive with common stocks in many cases."

A recent rate development may have affected some stocks which have been selling at very high price-earnings ratios and relatively low yields, says Young. That is the rate reduction ordered for Florida Power & Light. Young continues, "We think this order had a sobering effect on some investors who have been willing to buy stocks on utility companies in so-called growth areas at almost any price. We do not regard this rate reduction order as an indication of any new or unfriendly attitude on the part of regulatory bodies in general but, rather, as an isolated situation."

New financing ahead: Consumers Power Co plans to issue $70 million in securities—half in first mortgage bonds and half in convertible debentures . . . Duke Power asks authority to borrow $50 million through issuance of sinking fund debentures . . . Empire District Electric Co, Joplin, Mo., plans to raise $18 million in new money over next six years.

Other financing: Portland General Electric has entered into a $30-million credit agreement with a seven bank group . . . Salt River Power Project, Phoenix, Ariz., sells $5-million bond issue at interest cost of 4.28%. This rate is higher than the 4.09% accepted on a $10-million issue last November.

RATES

Chicago utility to ask rate increase. Commonwealth Edison Co has announced plans to file new rate schedules with Illinois Commerce Commission this month. Details have not been announced, but Board Chairman Willis Gale said higher money costs and rising prices require that Edison increase its rates.

Arkansas PSC orders preliminary survey to see whether full scale study of Southwestern Gas & Electric Co rates and accounting is warranted. Outside accountant firm will make preliminary study.

Federal Power Commission refuses to reconsider Pacific Gas & Electric Co plea for higher rates for sale of power to Sierra Pacific Power Co. FPC permitted the increase in 1954, but its decision was reversed by the Supreme Court.

Otter Tail Power Co readies first contract under irrigation pumping rate. This calls for annual fixed charge equal to 15% of the investment of the company in extension of lines or other expansion for individual load plus 1.2¢ net per kwhr energy charge. Service is interruptible.

Empire District Electric Co seeks 9% rate increase. It has filed applications with commissions in Oklahoma, Kansas, Arkansas, and Missouri. Average

residential bill would go up about 2¢ a day under proposal, company says. One application filed said the company is caught in a "cost squeeze" resulting from inflation and needs additional revenue to produce a fair return on its investment. It received its last general increase in 1952.

EMPLOYEE RELATIONS

Members of two IBEW locals vote to authorize strike if necessary in negotiations with Kansas City Power & Light Co. Wage provisions of contract expired June 30, and workers are seeking 8% increase. Company offers 5%.

Jurisdictional disputes hit construction at Ice Harbor Dam and the Hanford atomic project in Washington. In both cases pipefitters were protesting. At Ice Harbor the dispute was over an assignment to connect drainage pipe in foundation of dam. At Hanford it appeared to be over use of maintenance workers for construction duties.

Arizona's Supreme Court has declared union picketing unlawful if its purpose is to force an employer to discharge nonunion employees. The decision was viewed as strengthening Arizona's right-to-work law. Picketing, however peaceful, is unlawful when it comes at a time when the employer-employee relationship between picketers and employee has ceased, the court ruled.

TAXES

Houston Light & Power Co comes through with early payment of city ad valorem taxes. The $928,740.60 check not due until the end of year was paid in late June and saved city from borrowing money to meet current obligations.

Washington State Tax Commission ups valuation of utility properties in the state by average of 20% for tax purposes. Puget Sound Power & Light Co valuation was increased $14.5 million. Washington Water Power Co was up $8 million. Pacific Power & Light Co was up $7 million.

REGULATION

Mississippi Power & Light Co asks PSC permission to serve industrial plant south of Jackson. Capital Electric Power Association challenges petition, claims its lines are nearer to new plant.

Federal Power Commission authorizes Nantahala Power & Light Co, Franklin, N. C., to acquire all assets of Dillsboro and Sylvia Electric Light Co, Dillsboro, N. C. Dillsboro utility serves 2,070 customers, is worth an estimated $389,350.

Duke Power Co asks FPC for license covering one new development and ten existing developments. New project on the Catawba River west of Davidson, N. C., would have ultimate capacity of 350,000 kw.

ADVERTISING

Institutional advertising above or below line? Speaking before recent accounting section meeting of the Wisconsin Utilities Association, Wisconsin Public Service Commission Chairman George P. Steinmetz had this to say:

"Classification of nonpromotional advertising expenses—of the ECAP type— may require consideration. Normally these expenses are not large for an individual company and for a single customer would scarcely be noticed in his bill. However, the subject matter of some of these advertisements has little, if any, relation to the rendition of the utility service. It might prove to be an excellent public relations act if on such advertisement it was noted that its cost was not included in operating expenses and was not paid for by consumers."

AREA DEVELOPMENT

Fayette County (Pa.) Development Council offers $5,000 reward "for information leading to the establishment of each new industrial plant in the county." For copy, write Council at Box 272, Uniontown, Pa.

CHANCE Hot Line Tools

ARE *Aluminum Fitted* FOR LIGHTER WEIGHT

WIRE TONG

Easier to handle... Cause less fatigue

Chance Hot Line Tools are lighter in weight at the end of the pole—*where weight is important.* The end castings are made of heat-treated aluminum alloy . . . stronger fittings with less weight . . . tools with better balance to cut down fatigue, relieve strain on the lineman.

Chance Hot Line Tools help your crews do easier, safer, more efficient hot stick work. There are Chance tools to work all voltages from 6900 to 345,000 volts.

YOUR HOT LINE CREWS NEED THIS MANUAL

"Hot Sticks" is the most complete live line maintenance manual ever published. It has been used by supervisors and safety men all over the country to train hot stick crews in the safe way to do high voltage line maintenance. It talks the linemen's language—shows hundreds of detailed how-to-do-it drawings and diagrams for every operation. Every live line crew member should have a copy. Use the coupon to place your order.

O. G. "Andy" Anderson, America's best-known hot stick man, has tested and approved the design of all Chance Tools. That's why he says:

"GIVE THE MAN ON THE POLE A CHANCE FOR SAFETY"

Serving the Utility Industries since 1907

50 YEARS ANNIVERSARY
A. B. CHANCE COMPANY

CHANCE
Hot Line Tools
ARE *Aluminum Fitted*
FOR LIGHTER WEIGHT

WIRE TONG

Easier to handle...
Cause less fatigue

Chance Hot Line Tools are lighter in weight at the end of the pole—*where weight is important.* The end castings are made of heat-treated aluminum alloy . . . stronger fittings with less weight . . . tools with better balance to cut down fatigue, relieve strain on the lineman.

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CHAN
Hot L
Too
ARE *Plastic P*
FOR GREATER SAFETY...

AND

The poles used on all Chance
pletely sealed and protected wit
super-tough plastic finish that
moisture absorption, is not affecte
or salt water. "Maplac" provide
against finish damage but can be
sary. Its transparency permits visua

WIRE TONG SADDLE

EASY TO A

Chance Hot Line Too
on power poles with an
lever-action chain tight
safety latch automaticall
support in place . . . a h
ment gives a tight fit
seconds. The tightener
leased accidentally — tw
operations are necessar
powerful grip.

NCE
Line
ols
Protected
R

D DURABILITY

ance Hot Line Tools are com-
d with Chance "Maplac," a
hat resists abrasion, retards
ffected by oil, grease, gasoline
rovides maximum protection
n be readily repaired if neces-
visual inspection of the wood.

ATTACH

e Tools are mounted
th an easy-to-operate
tightener. A special
atically locks the tool
. . a half link adjust-
t fit on any pole in
tener cannot be re-
— two simultaneous
essary to release its

LP (LINEMEN'S PREFERENCE) Tools

Here's the new, easier way to select hot sticks for your maintenance crews. LP means Linemen's Preference—a term we've applied to the hot line tools used most and *preferred* by most linemen who *know* hot stick work. LP is like a seal of approval for hot line tools that have earned this rating. The list was developed by combining linemen's selections, determined by a nationwide field survey, with the preferred tools of our own demonstrators who do all kinds of hot stick jobs.

The list includes straight line tools, dead end tools, platforms, ladders, hand tools—everything required for hot stick work.

The LP list is valuable to you because it helps you select tools that your line crews will really like and use. We've printed a complete listing of these tools, punched to fit your CHANCE CATALOG. Use the coupon below for your copy.

A. B. CHANCE COMPANY
CENTRALIA, MISSOURI

Please send me the following items by return mail:

☐ Quantity — Now free handy list of "Linemen's Preference" Tools.

☐ Quantity — Copies of "Hot Sticks" @ $2.50 a copy. Bill us ___ Our check is enclosed ___

NAME & TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____

CT57-6

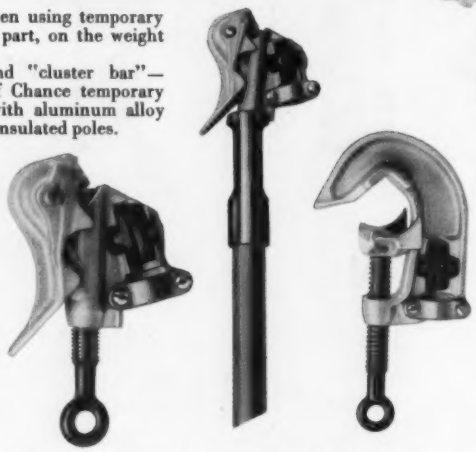
NEW

CHANCE LIGHTWEIGHT ALUMINUM GROUNDING EQUIPMENT

Easier to handle . . . takes No. 4 to 4/0 Cable

The safety and efficiency of linemen using temporary grounds for line repairs depends, in part, on the weight of the tools they use.

These new grounding clamps and "cluster bar"—typical of the complete new line of Chance temporary grounding equipment — are made with aluminum alloy to lighten the load on the end of the insulated poles.



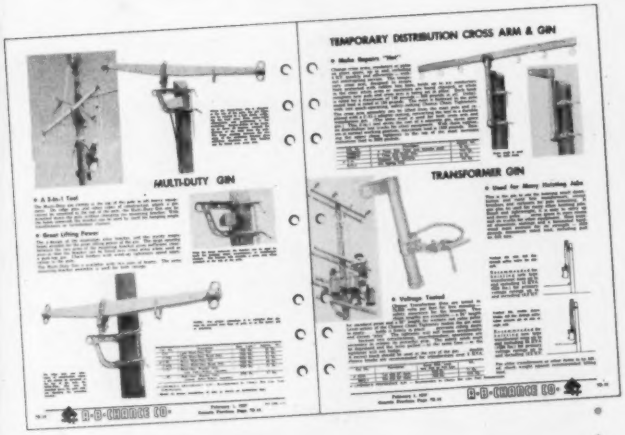
Another feature of importance to the user of Chance grounding clamps is the increased range in the jumper terminal size. Two sizes are available to accommodate cable from No. 4 minimum to 2/0 maximum or from No. 4 minimum to 4/0 maximum.

Chance grounding clamps are designed with "duck bills" that are easy to hook over the conductor and have fast action threads that screw up tight in a hurry.

Chance grounding clamps are available unmounted for handling with a clamp stick or mounted on laminated plastic-coated poles—the same as used on Chance hot line tools. The "Maplac" plastic coating is crystal clear, making it possible to visually inspect the wood. All poles are tested to withstand 75,000 volts per foot for five minutes.

The new clamps must pass constant current-carrying capacity tests and short circuit tests that guarantee their performance.

CHANCE Lifting Gins can be used many ways



The Chance Multi-Duty Gin is a 3-in-1 tool with great lifting power. It can be used on top the pole, down the pole, or without the beam as a transformer gin. The Temporary Distribution Cross Arm and Gin is a two-way tool that can be used as a temporary arm to support conductors for pole, arm, or insulator changes, or can be quickly converted to a transformer gin. The small Chance Transformer Gin is a lightweight, quickly applied tool for many lifting jobs. See your Chance Catalog Sheets 7B-13 and 14 for information.

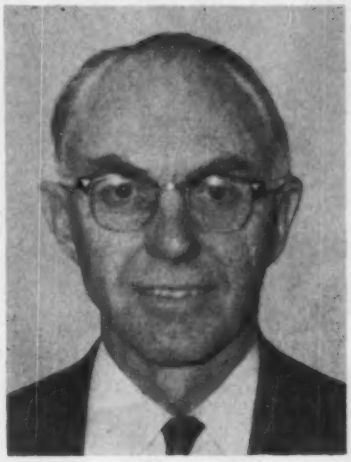
Protect your tools with the CHANCE trailer

Tools are protected from the weather, from scuffs and other physical damage when you use the Chance Hot Line Tool Trailer. They arrive on the job dry, safe, ready and handy for use. Chance Trailers are especially designed to carry hot line tools, and to make them easily accessible to your crews. Two types of trailers are available, the Heavy-Duty Trailers, shown above, and a sturdy Light-Weight Trailer that is easily transported by small pick-up trucks. Ask your Chance Representative, or write for full information and prices.

A·B·CHANCE CO·

ABC INDUSTRIES

CECIL H. KIRK



W. W. GERMAN

L. S. STADLER

Montana Power Names VP's

Burns and Doran are advanced to senior vice presidencies; five executives rise to VP positions

In a recent series of executive promotions, Montana Power Co elevated two vice presidents to senior vice presidents and elected five new vice presidents.

Advanced to positions of senior vice presidents were T. L. Doran, in charge of operations, and C. J. Burns, for labor relations, personnel, public relations, and sales.

The new vice presidents are: Cecil H. Kirk, who will be responsible for electrical operations; W. W. German; L. S. Stadler, who will direct natural gas operations; Colin W. Raff; and Harry C. Donaldson, who is also treasurer of the company. Kirk and Stadler will be responsible to Doran and Burns.

Kirk comes to his new post from that of superintendent of transmission and distribution for the entire system, to which he was named in 1949. A 35-year Montana Power man, he joined the utility as a helper at Ryan plant immediately after receiving his electrical engineering degree from University of Wisconsin. His rise from then on was steady: plant operator in 1923, plant construction foreman in 1926, plant foreman in 1927, Great Falls Division distribution engineer in 1930, city distribution superintendent in 1933, and superintendent of electric distribution for the system in 1941.

German, an electrical engineering graduate of Cornell University, is a former assistant to the vice president. During his 26 years with the utility he has also served as gas utilization engineer, chief gas engineer, and Butte Division manager.

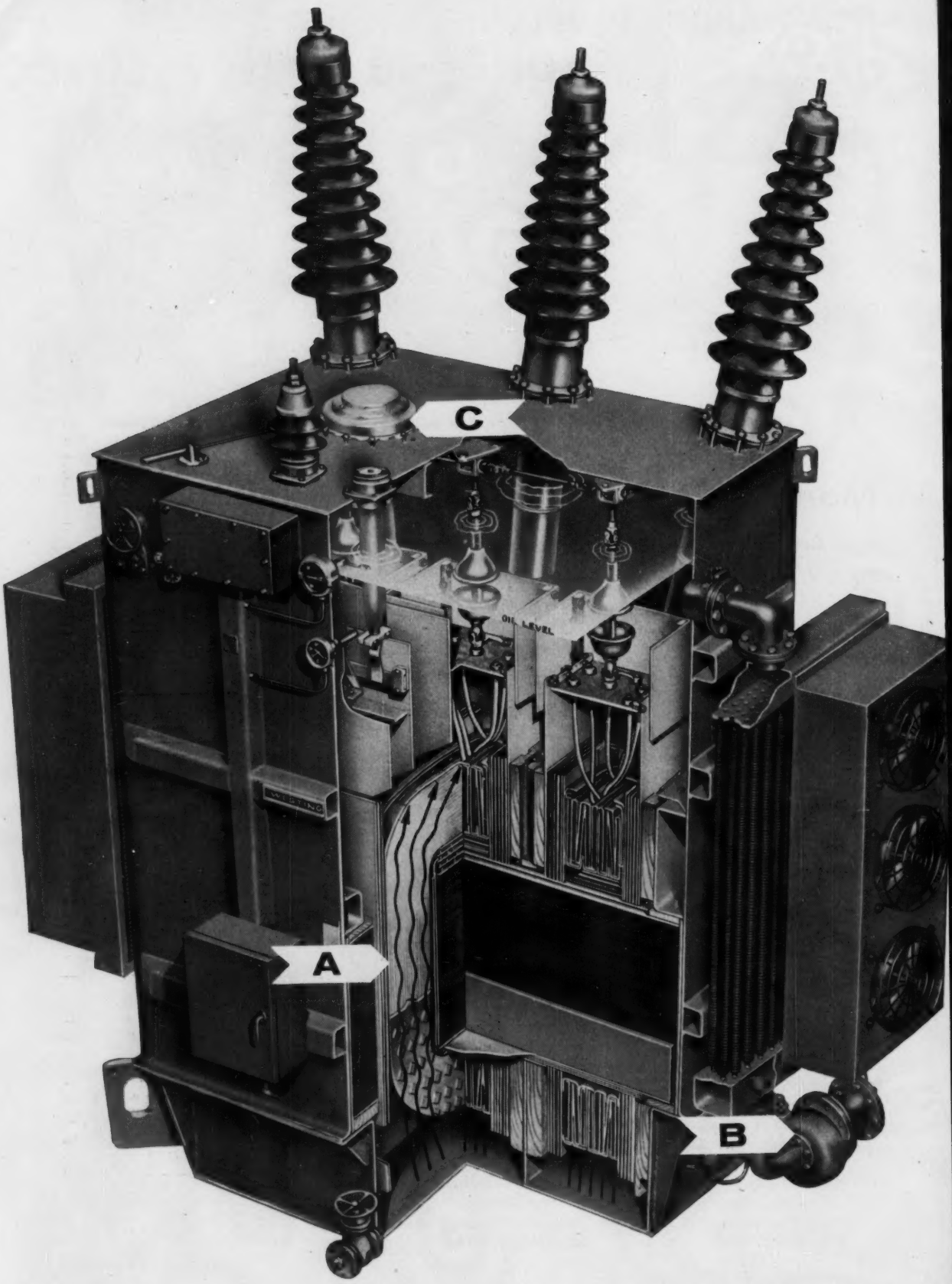
Stadler most recently served as manager of gas and oil. A Stanford University graduate, Stadler's experience in natural gas transmission, production and distribution dates back to 1931. Since then he has also been assistant gas engineer and chief gas engineer.

Raff, who has been executive assistant to the president, joined the utility's advertising staff in 1949 and later became head of that department. In 1953 he was named executive assistant to the officers of the company.

Donaldson, a 30-year Montana Power veteran, was recently promoted from assistant secretary and assistant treasurer to treasurer. Since joining the firm in 1927 he has also been chief clerk in Helena and chief accountant.

COLIN W. RAFF

HARRY C. DONALDSON


C
A
B

How Westinghouse safely* saved the electric utility industry $100,000,000!

Today, over 80 million kva of Westinghouse forced-oil-cooled transformers are delivering superior performance

In 1922, Westinghouse pioneered forced-oil cooling for power transformers. Since then, its inherent economies have saved electric utilities over $100,000,000. Here's why *you* get more transformer per dollar with Westinghouse . . .

A—*SUPERIOR COOLING ARRANGEMENT*

Form-Fit® design directs oil circulation to *all* parts of the winding. No special ducts or baffles. Rectangular-shaped coils placed vertically in the tank form long, vertical oil ducts. Oil is in direct contact with both sides of each coil. Hot-spot temperatures are reduced, service life extended and overload capacity increased.

B—*LOW-PRESSURE, HIGH-VOLUME OIL FLOW PROVIDED BY PUMPS*

Extremely low pressure and temperature differentials in the Westinghouse system of forced-oil cooling result in increased transformer life. The many parallel vertical ducts in the winding and cooler have exceptionally low-pressure drop even when large volume of oil is circulated by the low-head centrifugal pumps. With high-volume forced-oil cooling the difference between top and bottom oil temperature is held to a minimum with resultant low hot-spot temperatures.

C—*POSITIVE OIL PRESERVATION*

A completely sealed, inert gas system is recommended to keep moisture and atmospheric oxygen out and keep oil clean indefinitely. Maintenance costs are kept down—way down.

*Two proved gas systems are available—Inertaire® which maintains positive pressure at all times and Sealedaire†; both are sealed for complete protection.

For the full story of how Westinghouse power transformers with forced-oil cooling can save you money—in longer service life, lower maintenance and extra overload capacity—call your Westinghouse representative. Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70816

†Trade-Mark

YOU CAN BE SURE...IF IT'S

Westinghouse

L. F. HICKERNELL

LEONARD L. CARTER

HENRY V. VAN VALKENBURG

Anaconda W&C Advances Three Executives

Anaconda Wire & Cable Co has announced the appointments of L. F. Hickernell as vice president-engineering, Leonard L. Carter as chief engineer, and Henry V. Van Valkenburg as general sales manager.

Hickernell, who has been chief engineer since 1933, will now have full responsibility for directing the engineering as well as the research and development activities of the firm. A graduate of Grinnel College and Massachusetts Institute of Technology, he has been with AW&C since 1931. Hickernell is a fellow and a director of American Institute of Electrical Engineers, was recently elected AIEE treasurer, and has been endorsed as 1958-59 president of the organization by AIEE's Technical Operations Department.

Carter, who will now have general executive control over all activities of the engineering department, has been assistant chief engineer since 1936. During his 25-year association with AW&C, he has also been electrical engineer and general manager, Conductores Electricos S. A. de C. V. Mexico. A Purdue University graduate, Carter received the Eta Kappa Nu award for outstanding young electrical engineer in 1937.

Van Valkenburg has been sales manager at New York headquarters since 1955. His former positions with the company, which he joined in 1931, include sales engineer, district engineer, service engineer, and district manager. He holds an electrical engineering degree from University of Rhode Island.

PERSONAL BRIEFS

Charles D. Lyon has advanced from promotional manager to general commercial manager for the Potomac Edison System.

New general supintendent of production for Kentucky Utilities Co is **Henry L. Johnson.**

San Diego Gas & Electric Co has elected **Howard O. Craghead** secretary to succeed **Ray C. Cavell,** retired. Craghead is former assistant secretary.

At Detroit Edison Co, **John Davies** was advanced to assistant superintendent, East Division of overhead lines; **Leroy M. Hooper** to superintendent-Engineering and Service Division of underground lines; and **William R. Yelton** to engineering planning and layout supervisor of underground lines.

R. J. Bradley is now manager of Florida Power & Light Co's Coral Gables district . . . Dayton Power & Light Co has designated **Herbert Sowders** supervisor of its rural sales department.

Central Power & Light Co's **Sam H. Barnes** has been appointed to the new post of sales training coordinator for the company.

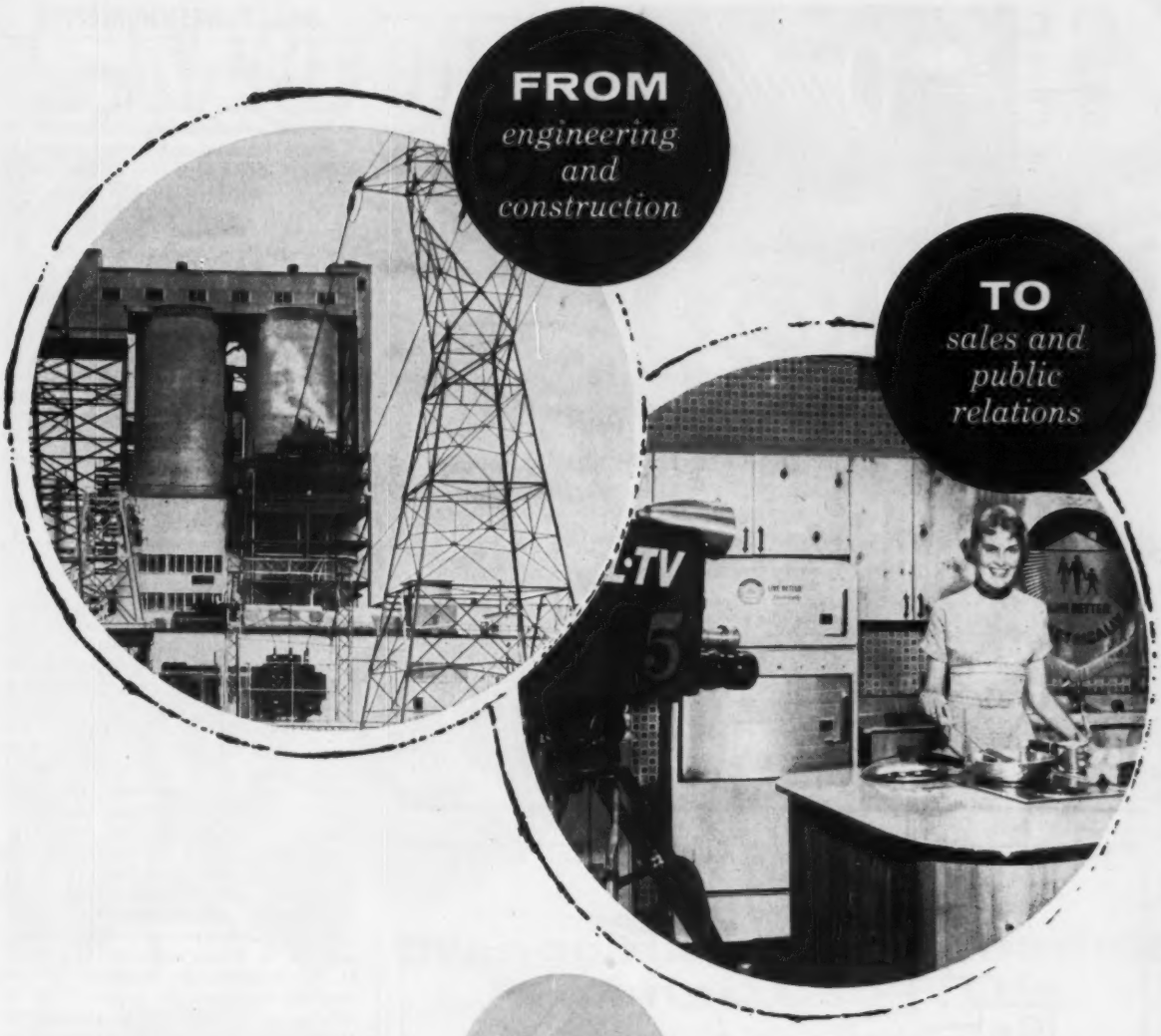
Portland General Electric Co has named **Victor W. Bacon** project foreman of its $25-million Pelton hydroelectric project in central Oregon. He will have complete charge of the facility upon its completion next fall.

Carl T. Loerner, a staff engineer with Pacific Telephone & Telegraph Co, was recently elected national president of Eta Kappa Nu Assn.

General Electric Co's real estate and construction operation, headed by **Robert L. Yowell,** has named **Thomas L. Kelly** project manager in the construction operation, **John M. Singer** administrator-real estate and construction operation, and **John W. Britten,** manager of construction contracts.

H. W. Cory has been appointed assistant manager of the control department and **W. F. Eagan** is new engineer-in-charge of control engineer at Allis-Chalmers Manufacturing Co . . . AC's General Products Division named **H. F. Banzhaf** assistant to the general manager.

Lawrence D. Gibson has been made industrial relations manager for Westinghouse Electric Corp's Sunnyvale Manufacturing Division and five other Pacific Coast plants.



you can count on quality performance

EBASCO offers many consulting services to utilities. All carry the same stamp of quality that identifies the power plants Ebasco designs and builds.

Take Ebasco's sales and public relations service, for example. It's continually helping solve problems for utilities all over the country. As a client, it offers you a constant flow of up-to-the-minute guidance and information, providing a sound basis for your day-by-day sales and public relations operations.

Or when special sales and public relations problems arise, the broad experience acquired by Ebasco's consultants is solid assurance of a practical solution.

For more information about these services, write: Ebasco Services Incorporated, *Sales, Marketing and Public Relations Consulting Dept.*, Two Rector Street, New York 6, New York.

Challenging career opportunities now available for qualified engineers. For further information, write to our Personnel Director.

ENGINEERS · CONSTRUCTORS
EBASCO
BUSINESS CONSULTANTS

Other Ebasco services for utilities include: APPRAISAL • FINANCIAL AND BUSINESS STUDIES • INDUSTRIAL RELATIONS • INSURANCE, PENSIONS AND SAFETY • PURCHASING, INSPECTION AND EXPEDITING • RATES AND PRICING • RESEARCH • SPACE PLANNING • SYSTEMS, METHODS AND BUDGETS • TAX • WASHINGTON OFFICE

NEW YORK · CHICAGO
DALLAS · PORTLAND, ORE.
SAN FRANCISCO · WASHINGTON, D. C.

450 KVA, three phase, dry type transformer. Primary 480 Secondary 208Y/120, 4—2 1/2% FCBN

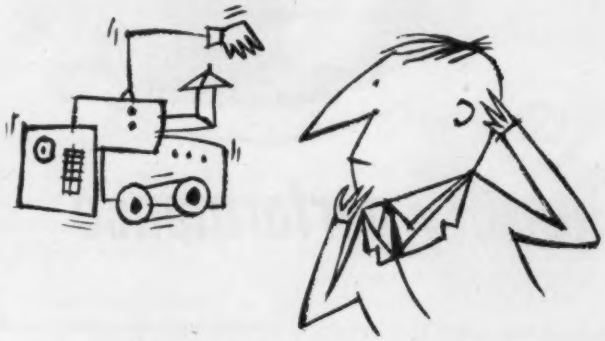
The fabulous Beverly Hilton has installed Marcus Transformers with a total capacity of approximately 2000 KVA. This guarantees them complete dependability and uninterrupted, trouble-free service for their power and lighting distribution.

A complete line of dry and liquid-filled transformers up to 5000 KVA.

Representatives in Principal Cities

"Mark of Quality"

Marcus TRANSFORMER CO., Inc.
RAHWAY, NEW JERSEY



What's a "Whatsamatron"?

We don't know—but if you've developed one lately . . . or come up with anything else new in products, procedures, new literature, research results, or what have you . . . why not give us the word. We'd like to hear all about it . . . and so would ELECTRICAL WORLD'S readers. Maybe you've expanded into new facilities, consolidated, shifted executive personnel, or maybe you've got product design or financial news. Whatever it is WORLD can bring it to the attention of the entire electric power industry. Like to know how? Just send for our booklet *"How to Get Maximum Value Out of the News Releases You Write for Electrical World."*

SALES ASSIGNMENTS

COMPANY STAFFS

American Brass Co has appointed Earl V. Pierce assistant sales manager of the Kenosha Division and named James L. Marvin Chicago district sales manager.

General Electric Co's Large Lamp Department has named James C. Forbes manager of residential sales, a new post, and Robert L. Oetting manager of the department's Southwestern sales district with headquarters in Dallas, Tex. . . . The User Industry Sales Department has the following six new managers: G. E. Hoopingarner, district product sales manager at Atlanta; John C. Ager, manager of utility sales for Alabama and Georgia; James L. Townsend, manager of industry sales for Georgia and Florida; H. B. Greear, district manager of application engineering with headquarters in Atlanta; J. W. Stone, district manager of marketing research; and R. L. Buchanan, Southeastern district manager of sales promotion, offices in Atlanta.

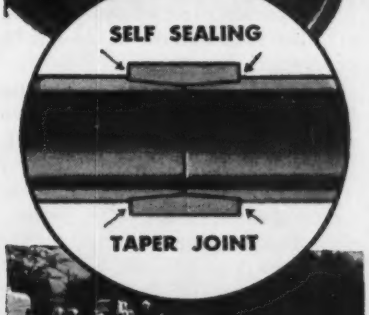
Graybar Electric Co has announced that Creighton C. Kohnert is new district appliance sales manager of its Gulf Coast district. In other company promotions, K. D. Leavitt was named district appliance sales manager at Cleveland; Rudy Johnson succeeded him as manager of major appliance sales at Cleveland; R. L. Layne was made appliance sales manager at Minneapolis to direct sales in the Twin City area; and R. W. Miller became appliance sales manager at the Duluth branch. Also advanced were E. E. Leavy, to assistant district manager at Los Angeles, effective August 16; H. G. Cook to Mississippi Valley district manager at St. Louis, effective August 1; D. A. Williams, to Wolverine district manager at Detroit, on August 1; W. B. Whaley to assistant district manager at Kansas City, Mo.; C. C. McGraw, to manager of supply sales at Houston, on August 1; and F. M. Sholders, branch manager at Omaha.

Westinghouse Electric Corp's appliance sales component has named Charles E. Schuster manager of the newly established Buffalo (N. Y.) branch. Arnold F. Buck is new Rocky Mountain district manager with headquarters in Denver, Colo. He will be responsible for sale of electrical apparatus to industrial and utility customers in Colorado and parts of Wyoming, South Dakota, New Mexico, Texas, and Arizona. . . B. J. Snow has become area sales manager in Dallas.

Index Available

The index for Vol 147, January through July 1957, will be bound in June 29 issue. Extra copies are free on request to: Information Service, Electrical World, 330 West 42nd Street, New York 36, N. Y.

SMOOTH BORE!



Orangeburg Fibre Conduit Prolongs Cable Life

Protect cable sheath from abrasion and you prolong the life of underground cables, say utility engineers. Scoring of cable sheath creates "trouble spots" that shorten cable life.

That's where Orangeburg Fibre Conduit plays an important part in keeping cables healthy. Orangeburg's smooth bore, its low coefficient of friction minimize the danger of abrasion when cables are pulled in, as well as later on during cable movement. By protecting cable sheath from abrasion, Orangeburg Fibre Conduit adds years to cable life.

Orangeburg's impermeable wall and watertight joints protect cables from corrosive ground waters. Its nonmetallic material is strong, tough, resilient, long lasting.

And, remember, Orangeburg lays faster and at lower cost than other types of conduit. It is light in weight, easy to handle, easy to tool on the job. Spacers, bends, fittings, 5° bend sections and lightweight tapering tool, all combine to simplify installation.

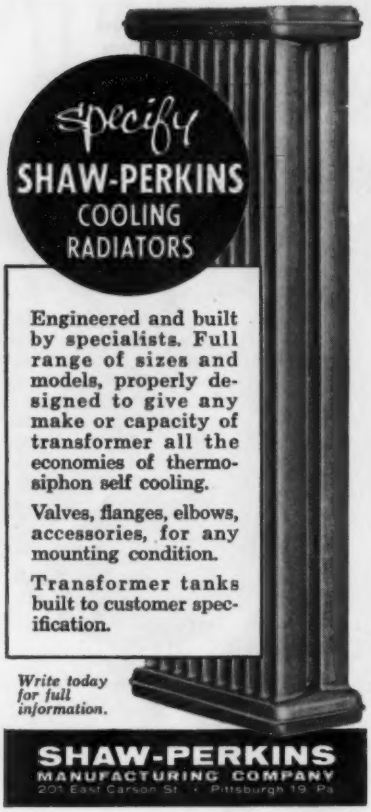
Since 1893, records of long life have proved Orangeburg's durability and economy.

Orangeburg Fibre Conduit is distributed by Graybar Electric Company and General Electric Supply Company with branches and stocks in principal cities.

WRITE DEPT. EW-77 FOR NEW CATALOG 52.

ORANGEBURG MANUFACTURING CO., INC., Orangeburg, N. Y. West Coast Plant, Newark, Calif.

ORANGEBURG®
FIBRE CONDUIT


specify
SHAW-PERKINS
COOLING
RADIATORS
Engineered and built by specialists. Full range of sizes and models, properly designed to give any make or capacity of transformer all the economies of thermo-siphon self cooling.
Valves, flanges, elbows, accessories, for any mounting condition.
Transformer tanks built to customer specification.
Write today for full information.
SHAW-PERKINS
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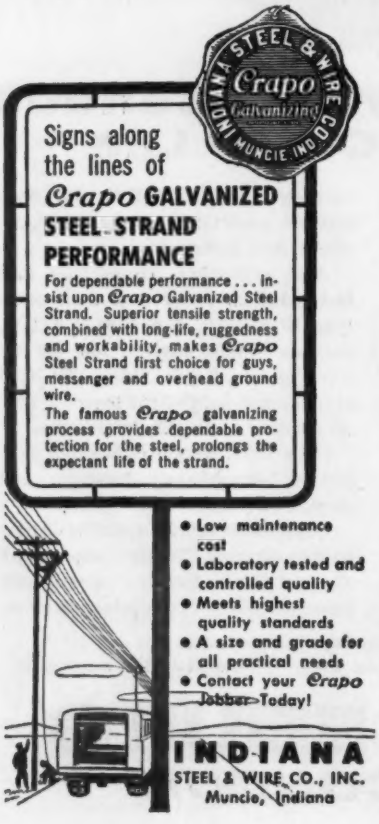
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READERS FORUM

Good Idea if It Works

To the Editor:

Re: Bo Rush Letter—Woodpecker—Readers Forum, June 10.

All Bo Rush has to do to solve his woodpecker problem is to convince his king-size pileated feathered "friends" that they are really Texans.

This should result in the woodpeckers starting to drill for oil instead of attacking Bo's poles. And as the water is so close to the ground in Louisiana, they will "strike water" and drown; and Bo's troubles will all be over.

How do you convince a woodpecker that he is really a Texan?

That's Bo's problem—I'm just an "idea man."

Kenneth R. Miller
Preformed Line Products Co
Cleveland 14, Ohio

New Jersey Demand Up

To the Editor:

I have read with interest your article in the June 24 issue about the heat storms in New York and Chicago

I call to your attention the fact that your article did not include New Jersey where we really have been breaking load and output records. On Tuesday, June 18, at 2 PM, a new peak load for the Public Service Electric & Gas Co system of 2,273 Mw was experienced. This was a gain of 200 Mw (9.6%) over the previous system winter peak which occurred in January 1957 and a gain of 318 Mw (16.3%) over the previous summer peak load which occurred on June 14, 1956. It exceeded our 2,150 Mw forecast for the 1957 summer peak load by 123 Mw and our 2,240 Mw forecast for the 1957 December peak by 33 Mw.

On the day when this extraordinary demand occurred the kilowatthour output was also at a new high level—40.4 million kwhr compared with a previous record maximum daily output of 36.7 million kwhr on Jan. 15, 1957, an increase of about 10%. It is an increase of almost 15% over the 35.2 million kwhr maximum daily summer output of June 1956.

Our industrial load is at a high level but the magnitude of the increase in load and output undoubtedly is due to air conditioning and other cooling equipment. So while New Jersey is not so renowned for hot summers as some other sections of the country, we, nevertheless, are experiencing large increases in summer peak load and output.

Watson F. Tait, Jr.
Executive Vice President
Public Service Electric & Gas Co
Newark 1, N. J.

Views of Meters Clarified

To the Editor:

The readers of Electrical World may be interested in clarification of my remarks at the Edison Electric Institute Meter and Service Committee as reported on page 86 of the May 20 issue.

At the meeting, I evaluated the practicability of universally applying one type of meter to all 3-wire and 4-wire services, both single phase and polyphase and indicated, in the present state of the metering art, that such a move would not be economic.

I stated, however, that it would be economic to standardize on three different "general purpose" meters; (1) single-stator with two current windings for 2-wire and 3-wire single-phase circuits, (2) 2-stator with two current windings for 3-wire open Y and 3-wire poly-phase circuits, and (3) 2-stator with four current windings for 4-wire delta and Y circuits.

I further stated that a general purpose meter equally suited to both wye and delta services, covered by (3) above, could now be produced, as evidenced by one manufacturer's presentation at the meeting, and that the adoption of this type of meter in a single standard form by the industry would result in important savings.

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The V2JS provides the KWH reading for billing as well as a record of minimum and maximum volts. Whenever the watthour meter is read, voltage findings are reported to the Engineering Department. The V2JS can also be used to check voltage complaints from individual customers, or to indicate transformer adequacy.

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SM57-4

Is Industry Creating A New Breed of "Bonus Babies"?

THE STARTING SALARIES offered to this year's June graduates give the impression that industry is creating a new breed of "bonus babies." This is the term baseball fans apply to sturdy youngsters whose talent for hitting and throwing gets them payments of up to $100,000 and other benefits for signing a contract.

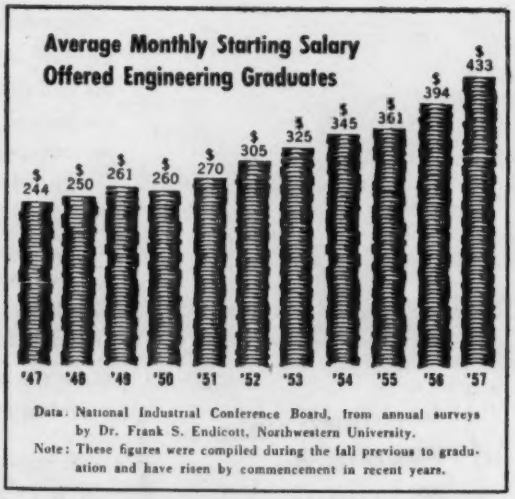
For several years industry's demand for young college graduates, especially in science and engineering, has outrun the number receiving degrees. Competition for these young people has steadily pushed up the starting salaries and has induced many companies to indulge in lavish recruiting programs. This year engineering graduates are being offered well over $400 a month, and even liberal arts graduates find numerous offers at $400 or more. Only ten years ago the salaries offered senior engineering students averaged less than $250 a month.

But any employer who assumes that high starting salaries alone will assure him the number of June graduates he wants is likely to be disappointed. A recent study by the McGraw-Hill Classified Advertising Division shows that most young engineers and scientists going into industry are more interested in their opportunities and in a company's future than they are in the size of their first paycheck.

Money Isn't Everything

In the McGraw-Hill survey, 2,596 recently-hired engineers and scientists employed in 57 companies listed the factors they had considered before accepting a position. The replies of the younger engineers and scientists—those with less than five years' experience — have great significance for employers who want to make any impression in the highly competitive market for college graduates.

- **Potential growth of the company** was listed by more young engineers and scientists than any of the 42 other items on the list as a factor that influenced greatly their decision in accepting a position.
- **Challenging opportunity** was second.
- **The company's prestige and reputation** ranked third.



Data: National Industrial Conference Board, from annual surveys by Dr. Frank S. Endicott, Northwestern University.
Note: These figures were compiled during the fall previous to graduation and have risen by commencement in recent years.

● **Progressive research and development program** was fourth.

● **Starting salary** ranked only **seventh.**

Job and Future Most Important

As a group, the factors relating to the nature of the job, its future and the company's future had by far the greatest influence in attracting young engineers and scientists to their present positions. These include three of the top four attractions—potential growth of the company, a challenging opportunity and a progressive research and development program. Other factors in this group are the company's facilities, quick advancement, self-direction or little supervision, chance to work in a certain field, small size of company and rewards for individual accomplishment.

The second most important group of attractions had to do with prestige. These include the company's prestige and reputation, executive or professional standing and association with leading men in the field. **Third in importance were financial considerations**—starting salary, regular salary increases, financing of relocation, paid vacations and holidays.

A less important group of factors influencing young scientists and engineers were essentially social. Geographic location and educational facilities in vicinity ranked fairly high. But recreational facilities, suburban or country living, pleasant housing and cultural considerations had little appeal.

Ranking lowest, by a good margin, were factors having to do with security—permanent position; health, life and surgical insurance; retirement or pension plan; and sick leave.

It is interesting to note that some of the factors which influenced the **smallest** percentage of young engineers and scientists were country club memberships, use of company car, at-cost or low-cost eating place, travel opportunities abroad and being able to buy the company's products at a discount.

A Lesson For Employers

The lesson of this survey to employers who hope to recruit more young engineers and scientists is clear. High salaries and other financial appeals are important. But, **at a time when high starting salaries are offered in abundance, our young graduates are interested even more in being with companies that will grow and in jobs that will permit them to grow. They are interested in jobs that offer opportunities for advancement, financially and professionally.**

* * *

Were the young scientists and engineers who participated in the survey trying to impress somebody with their motives? If so, it could only have been to impress themselves, for all were asked to return their questionnaires unsigned.

What Factors Influence the Job Selections of Young Engineers and Scientists?

Factors Influencing Decision Greatly	Percent Listing Factor
Potential growth of company	55%
Challenging opportunity	53
Company's prestige, reputation	44
Progressive research and development program	41
Geographic location	37
Permanent position	35
Starting salary	34
Educational facilities in vicinity	33
Regular salary increases	31
Chance to work on specific project, or in certain field	27
Company's facilities (laboratories, technical libraries, etc.)	25
Tuition for graduate study	25

Based on replies by recently-hired engineers and scientists with less than five years' experience to questionnaire distributed by McGraw-Hill Classified Advertising Division.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C McGraw

PRESIDENT

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Sealed bids will be received in the office of the Engineering and Construction Director, Panama Canal Company, Balboa Heights, Canal Zone until 10:00 A.M., E.S.T., August 21, 1957 and at that time publicly opened for the following work: Furnishing all plant labor, materials, equipment and services and performing all work required to replace switchgear in the Miraflores substation. This work consists of demolition of existing concrete switch cells, bus structure and instrument transformer compartments; furnishing and installation of 23 units of 2.4 KV and 12 units of 12 KV metal clad switchgear, a five (5) panel duplex control board, two (2) 5000 KVA, 3 phase, 60 cycle transformers and one (1) 10,000 KVA, 3 phase, 60 cycle power transformer. It also consists of removal of 25 cycle transformers from the substation, alterations to switch structure in high tension room, the installation of nine (9) 44 KV oil circuit breakers and the relocation of approximately 1000 feet of 44 KV transmission line. Specifications and drawings are available for examinations at the office of Chief of Procurement, Panama Canal Company, 21 West Street, New York 6, New York and may be obtained upon payment of a deposit of $50.00 which is refunded if data are returned within 40 calendar days after bid opening. For further information contact this office, 21 West Street, New York 6, N. Y. Telephone Bowling Green 9-5380, extension 56.

Sealed bids will be received in the office of the Engineering and Construction Director, Panama Canal Company, Balboa Heights, Canal Zone, until 10:00 A.M. E.S.T. September 13, 1957 and at that time will be publicly opened, for the following: Furnishing all plant, labor, materials, equipment, and services and performing all work to convert domestic, commercial, and industrial equipment in the Miraflores and West Bank area of the Panama Canal Zone, which includes Pedro Miguel, Miraflores Filtration and Pumping Plant, Palo Seco, but does not include the Miraflores or Pedro Miguel Locks. Bid data, specifications, and drawings are available for examination in the office of Chief, Procurement Division, 21 West St., New York 6, N. Y. Sets of data may be obtained from this office upon payment of $25 deposit which will be refunded if data is returned within 40 calendar days after the bid opening.

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3—	333 KVA A-Ch 2400-480
6—	250 KVA W-H 22000-7200/12470Y
3—	200 KVA Mol 7200-2400/4160Y
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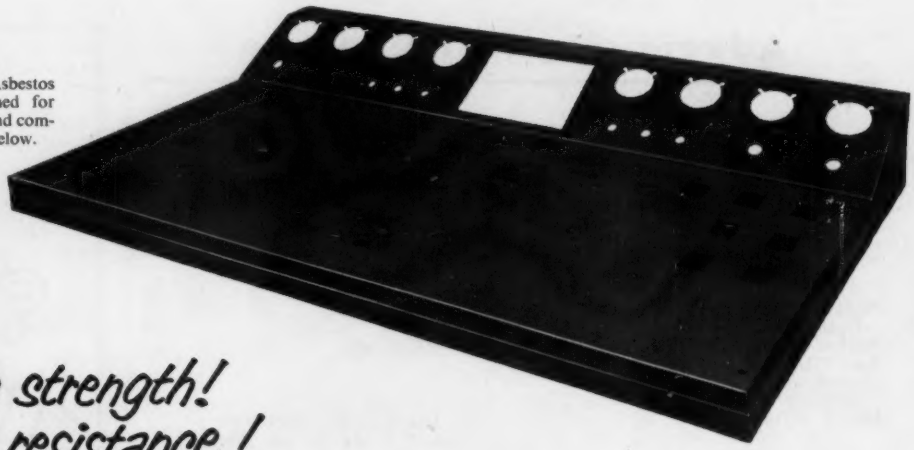
330 W. 42nd St.,
New York 36, N. Y.

Photo shows J-M Asbestos Ebony panels machined for bridge control bench and complete unit assembled below.



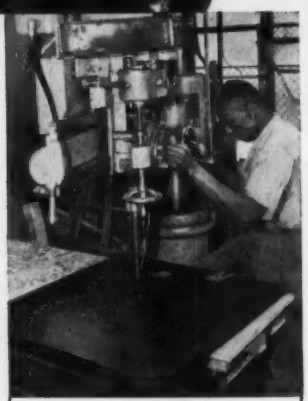
✓ *Dielectric strength!*
✓ *Insulation resistance!*
✓ *Mechanical strength!*

This console is high in all three because it's made of J-M ASBESTOS EBONY

AN OUTSTANDING COMBINATION of dielectric strength, mechanical strength and insulation resistance . . . that's what you get when you specify Johns-Manville Asbestos Ebony for electric panel boards.

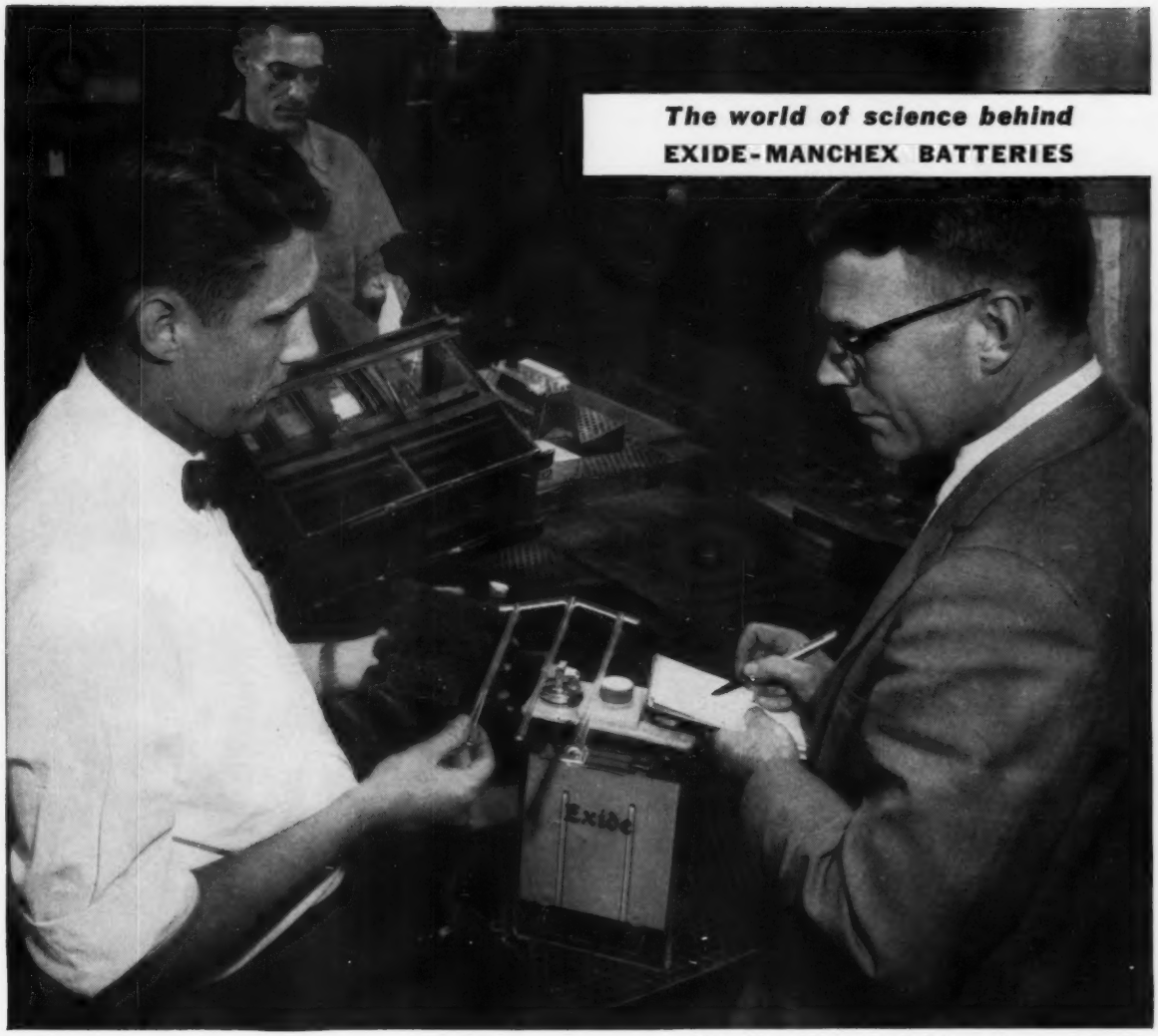
Asbestos Ebony does not delaminate, shrink or crack even under severe service conditions. It is unaffected by water, oil, gas, most common chemicals and rapid temperature changes. Under moist conditions, it will not rust or corrode. It is attractive in appearance with a rich ebonylike surface.

Made from asbestos fibre and portland cement bonded under high pressure and impregnated with an asphaltic insulating compound, Asbestos Ebony is specially designed for electrical equipment. Among the applications where it has provided many years of dependable performance are panel boards for switchboards, controller plates, switch bases, bus bar supports, knife switches and circuit breakers. Thicknesses range from ⅛" to 4". For further information, write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.



EASY TO WORK
Asbestos Ebony is readily fabricated and machined with ordinary metal working tools.

Johns-Manville ASBESTOS EBONY®



Being interviewed is E. L. Daniels, Jr., development engineer

"These wide open spacers boost battery power"

At the Exide Laboratories—**Reporter:** When is it most important for a battery to have maximum power, Mr. Daniels?

Daniels: Under short, heavy loads—such as when equipment is switched on or off.

Reporter: How do the wide open spacers help?

Daniels: By providing a shorter, more direct current path between the plates. Hence the internal resistance of the battery is reduced. This is reflected in improved voltage, increased current capacity, and less heating under load.

Reporter: Are there any other advantages to these spacers?

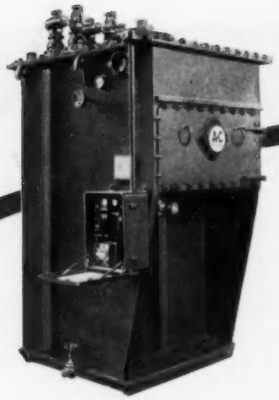
Daniels: Yes, electrolyte has easier access to plates for better constant load battery performance. And the open spacers allow used active material to fall more readily to the bottom of the jar.

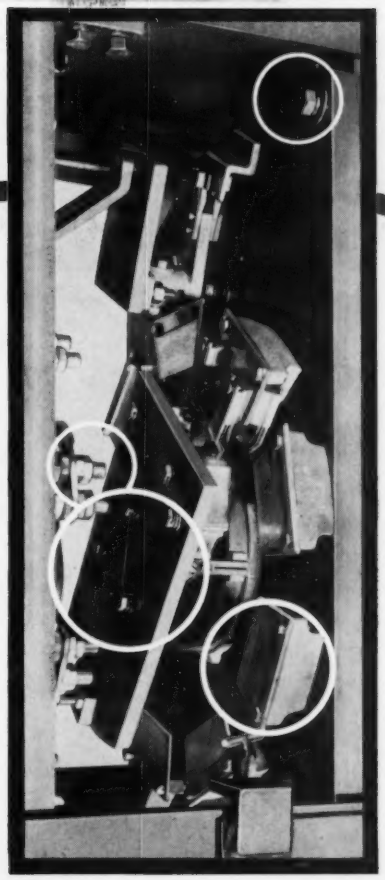
Reporter: Obviously, this is an important feature of Exide-Manchex Batteries.

Daniels: Yes it is. But it's only one of the many engineering details that contribute to their long life and high performance.

Note to battery users: Whenever you order batteries for float or cycle service in stationary applications, be sure to specify Exide-Manchex. Write for detailed bulletin. Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 2, Pa.

THE ELECTRIC STORAGE BATTERY COMPANY Exide®





reasons for remarkable service of ALLIS-CHALMERS 3-phase regulators

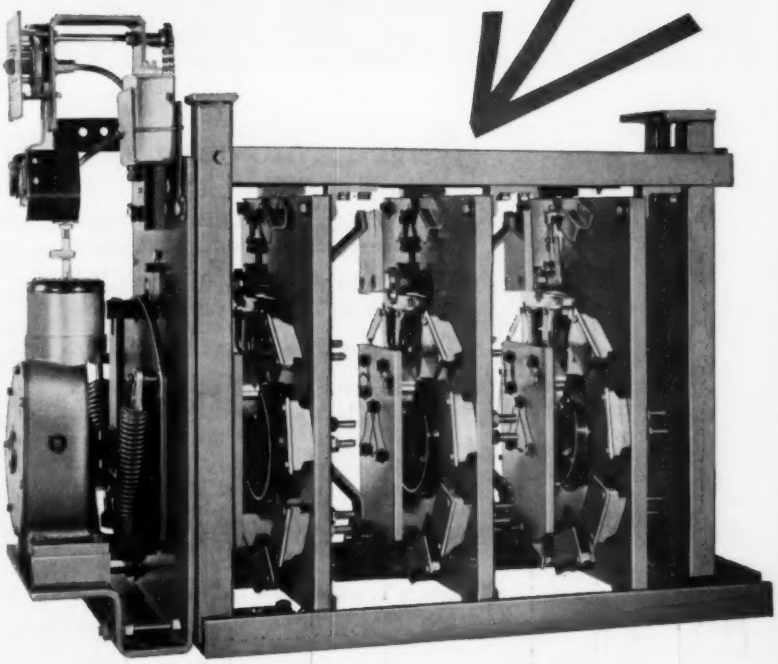
rigid mechanism

The extra heavy tap-changing mechanism is built to withstand the most severe operating conditions. From the rigid mounting frame of bolted and welded construction down to the smallest component, all parts are sized for long service life. In fact, a unit recently inspected after 20 years' operation showed no appreciable wear.

In addition, the quick-break tap changer operates on balanced spring principle—snubs fast moving parts to quick stop without shock.

Six types of locking devices add to rigidity of mechanism. Wired bolt heads, fine threaded bolts, prick punching, locking strips, lock washers, and nuts are all used to assure rigidity year in and year out.

These are only a few of the many reasons for the remarkable service record of Allis-Chalmers 3-phase regulators. For all the reasons, contact your local A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



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ALLIS-CHALMERS